

# Aviation Week

*and Space Technology*

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February 29, 1960

National Product  
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# NEW

## KAYLOCK® "CAPTIVE WASHER" NUT

ENDS WASHER WANDERLUST



HW14



Costly time is wasted on washers with wanderlust. Small, slippery, they roll away, drop off, slide into the hardest-to-get-at places. Now, Kaynar has solved the problem with the new Kaylock HW14 "Captive Washer" Nut, an HW14 lightweight, all-metal, self-locking nut with integral, drop-in, captive washer. Stabilizes frictional characteristics between nut base and internal structure. Result: controlled joint tightness.

**Sever Assembly Time.** Kaylock HW14's cut extra motion required to put washer on both. Washer can't drop off during application or removal. Cuts time lost looking for wayward washers... to zero.

**Safe too.** There is no chance of equipment jamming or becoming destroyed because of nuts and washers vibrating loose. Kaylock HW14 also employs the same, now official locking principle to prevent vibration hazards. The Kaylock HW14 is a new product development of Kaynar Mfg. Co. Inc., world's oldest and largest manufacturer of lightweight, all-metal, self-locking nuts. For further information, contact your Kaylock representative or write or call Kaynar directly.



**Kaylock** first in lightweight locknuts

Kaynar Mfg. Co. Inc., Kaylock Division, Box 7001, Thermal Avenue, Los Angeles 34, Calif.  
Branch offices, warehouses & representatives in: Wichita, Kansas; New York, N.Y.; Atlanta, Ga.;  
Reno, Washington; Canadian Division, Alcanco Aero. Ltd., Montreal, Quebec.

Need a **NONCRITICAL** material  
to solve a **CRITICAL** heat problem?

Consider these Goodyear Aircraft capabilities in the field of high-temperature laminates—



**HERE'S AN IMPROVED BLAST DEFLECTOR**—made of reinforced plastic— which can withstand the direct blast of rocket engines. Goodyear Aircraft stands ready to design and fabricate economical, reusable blast deflectors to your special requirements.



**CRYSTALLINE FUEL TANK INSULATION** by Goodyear Aircraft is less than 1/4 inch thick, yet has proved its ability to prevent "boil off" of liquid gaseous rocket fuels, such as liquid nitrogen and liquid hydrogen. Use of a plastic laminate for this purpose can mean substantial weight, space and cost savings.



**HOSE CONES FOR GLIDE-BOATY VEHICLES** can be produced at Goodyear Aircraft to a wide range of specifications. The reason: extensive experience with plastics and their advanced techniques. Do you need a lightweight hose cone material that can withstand 2000° to 2500° for an hour or more? Whatever your specialty requirements, a specially compounded high-temperature laminate may well be the answer.



**LEADING EDGES OF MISSILES** (or aircraft) can be protected against prolonged high-temperature exposure by plastic laminate coverings which conform to the model's structure. Semi-rigid plastic laminates by Goodyear Aircraft can also be used for jet nozzles, rocket nozzles, fins and other missile/aerospace machine components.



**BAGGAGES FOR AIRCRAFT** which operate at Mach 31 and above have been produced at Goodyear Aircraft. Goodyear Aircraft has a vast background in rubber engineering and manufacturing for both the solid and honeycombed tapered constructions.



**"PLASTIC" MISSILES**—built by Goodyear Aircraft—would still use a variety of plastic laminates and fibrous reinforcement. Advantages of such all-plastic construction: no use of critical materials, high strength-to-weight ratio, low cost in mass production, rust and corrosion resistant.

Your inquiry is invited regarding these specific capabilities—or any requirement calling for a specialized, light-strength material which must retain its properties under the most demanding heat and stress conditions. WRITE: Goodyear Aircraft Corporation, Dept. 1154M, Akron 16, Ohio.

ENGINEERED PLASTICS—ONE OF THE PRIME CAPABILITIES OF

**GOODYEAR AIRCRAFT**

PLASTIC IN AKRON, OHIO, AND (GOODYEAR PARK, ARIZONA)





Now being delivered to the U. S. Weather Bureau are WSR-57 weather detection radars. Each unit covers 200,000 square miles, tracks storms, identifies rain, snow and fog. This equipment is designed and produced by Raytheon.



## AVIATION CALENDAR

**FACTORY FRESH  
CERTIFIED PRECISION**



APPROXIMATELY 100,000  
vertical gyroscopes are used in  
military and civilian aircraft.



## VERTICAL FREE DIRECTIONAL GYROS by Iron Fireman

Specified by major manufacturers  
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These Iron Fireman gyros have  
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Vertical gyroscopes  
used in 100,000  
military and civilian  
aircraft.

Vertical gyroscopes  
used in 100,000  
military and civilian  
aircraft.

## AVIATION CALENDAR

(Continued from page 5)

General Professional Group on Human Factors at Kirtland.

Apr. 28-30 National Aerospace Meeting and Meeting and Aircraft Engineering Society of Automotive Engineers, Commack, N.Y.

Apr. 28-30 National Meeting of Space Vehicle Conference, Baltimore Hotel, Suite 2000, Baltimore, Md. Sponsor: American Rocket Society's Structures and Materials Committee.

Apr. 28-30 National Meeting "Hyper-Environment-Space Problems," Institute of Environmental Sciences, Belmont Hotel, Los Angeles, Calif.

Apr. 18-20 National Engineering in Space Technology, Hotel, Belmont Hotel, Los Angeles, Calif. Sponsor: American Institute of Electrical Engineers.

Apr. 12-13-14th Annual Spring Technical Conference, Institute of the Aerospace Rocket Society, Hotel Alton, Cincinnati, Ohio.

Apr. 18-21 International Symposium on Active Networks and Feedback Systems, New York, N.Y. Sponsor: Polytechnic Institute of Brooklyn, Department of Defense Research Agency, Institute of Radio Engineers.

Apr. 20-22 - National Symposium on Man-Made Space Systems, Institute of the Aerospace Sciences, Ambassador Hotel, Los Angeles, Calif. Cosponsors: NASA, the Rand Corp.

Apr. 21-National Electronic Regional Meeting, Institute of Navigation, Key Bridge Marriott Motor Hotel, Washington, D.C.

Apr. 21-23-Southeastern Metals & Minerals Conference, Metals and Minerals for the Space Age, American Institute of Mining, Metallurgical and Petroleum Engineers, Anaheim Hotel, Los Angeles.

Apr. 27-28-National Meeting in Space Age Materials, Cosponsors: Chapter of the American Society for Metals, Western General Hotel, Cincinnati, Ohio.

Apr. 18-19-20 Symposium on Cloud Control Regulation Systems, Wright Air Development Division, Wright Patterson AFB, Ohio.

May 2-4-National Aeronautical Electronics Conference, Baltimore and Annapolis Hotel, Dayton, Ohio. Sponsor: Institute of Radio Engineers.

May 23-24th National Flight Test Symposium, International Society of America, San Diego, Calif.

May 23-24th Symposium of the Institute of Radio Engineers Professional Group on Microwave Theory and Techniques, Hotel del Coronado, San Diego.

May 20-22-24th Electronics Components Conference, Willard Hotel, Washington D.C. Sponsor: Institute of Radio Engineers Professional Group on Components.

May 20-22-24th Electronics Components Conference, Willard Hotel, Washington D.C. Sponsor: Institute of Radio Engineers Professional Group on Components.

May 21-24-35th Annual National Forum, American Hydrocarbon Society, Sheraton Park Hotel, Washington D.C.

Aug. 19-20-21-22-23rd Annual Congress, International Astronautical Federation, Royal Institute of Technology, Stockholm, Sweden.

## High alloy performance with Timken® low alloy steel



You keep maximum strength up to 1000°F. If you are using expensive, high alloy steels for missile engine parts, aircraft brakes, gas turbines or other high temperature applications, use Timken® low alloy "7-12-A" steels. Do less than 1% alloy content, you

get high alloy performance—with maximum strength up to 1100°F.

Besides saving your initial costs, Timken® "7-12-A" steels have high resistance to heat checking and thermal cracking. They are readily workable up to 2300°F and are easily machined and welded. In fact, maximum high temperature properties can be developed by normalizing and tempering. You practically eliminate the chance of distortion and quench cracking.

Want more details on this money-saving steel? Send for Technical Bulletin 568. And let our metallurgists help solve your high temperature steel

problems. They've solved thousands already. When you buy Timken steel you get:

1) Quality that's uniform from heat to heat, bar to bar, order to order. 2) Personal attention from the experts in specialty steels. 3) Over 40 years' experience in solving tough steel problems. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMKENCO", Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

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that  
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Please send complete data on Purolator filters with  
Pressure Lock elements.

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**IT'S A PUROLATOR  
PRESSURE LOCK FILTER ELEMENT  
AND LOOK WHAT IT DOES:**

- Gives you a filter that's free of ballast contamination
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Only Pressure Lock will do it,  
and this is why.

Pressure Lock is an exclusive Purolator process of assembling a vitreous filter medium without welding, brazing or cementing, and without the contamination that any of these methods produce. Pressure Lock encases the filter medium in the real cage in an absolute bond that contains no material other than the metal of the cage and filter medium. As a result, the only limitation to the performance of a Pressure Lock filter — temperature, pressure, vibration, filtration or weight — is the physical properties of the construction metals.

Present ratings are for a nominal 10 micron (absolute maximum particle size of 25 microns) and for a nominal 5 micron (absolute maximum particle size of 25 microns), in capacities of 1, 3, 6 and 12 CFM. Higher capacity elements are being processed for early production.

The Pressure Lock process provides, literally, a new standard for filter applications in aircraft and space, industrial hydraulics, pneumatics and chemical process industries. Fill up the coupon and send it now for further information.

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PS-02 — 4 to 25 vdc on 2 volt steps, 20 amps  
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This extensive completion program at Affirmance Aviation Service for Grumman's new prop jet corporate transport includes: custom business interiors... soundproofing... radar... radio... autopilot... instrumentation... paint... maintenance.

Research personnel have been factory trained for this special program. Expert craftsmen utilize the newest materials and processes in building and installing lightweight, fully stressed furniture, lounges, galleys, lavatories and other appointments custom designed for the individual Galileon's customer.

Our acoustical requirements have developed three individual degrees of soundproofing insulation for the Callareum to insure the constant level you desire.

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By using a full scale mockup of the fuselage section, we are able to prefabricate components for the Galstream to expedite delivery time. And AirResearch guarantees the completion weight of your aircraft.

AdResearch has more experience in proscripted aircraft than any other modifications center.

Write, wire or telephone for complete information, including brochure, on the AIRsearch Completion Program for the Gramm Leach Bliley Act.



Grassroots Diffusion: undergoing a system reform completion process at the Ashland Health Services Center facility.

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**HYDRAULIC RESEARCH** derives pressure feedback servo valve was developed for systems where servo response is limited by load resonance. The valve functions as a flow controller essentially, and has the combined characteristics of a pressure-controller and flow controller dynamically. The dynamic characteristics are obtained by the use of load pressure feedback which is obtained statically by a derivative network. Unit is in production. Write today for complete details and specifications.



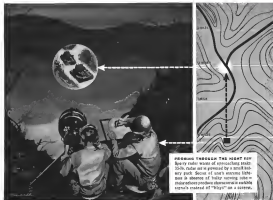
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*Salisbury of Bell Aircraft Corp.*[illegible]





**PEERING THROUGH THE NIGHT FOR** heavy radar waves of approaching tanks, tanks, radar and is powered by a small battery pack. Secret of unit's enormous lifespan is absence of bulky servicing tube — maintenance problem elsewhere is easily solved instead of "blowing" on a battery.

## Army has "Silent Sentry" Radar for front-line use

**SILENT SENTRY** radar is now the Army's "Silent Sentry" (AN/PPS-4) with its 10 ft. tower and 10 ft. antenna. These design of strength in U. S. defense will be used extensively throughout main Air Force defense network.



Army troops are now able to call upon the country's first production equipment of this size. The device — designed to work of surprise even the ground antitank or major attack by an aggressor — greatly minimizes the effectiveness of hostile anti-aircraft.

Developed jointly with the Army Signal Corps, this new Sperry portable radar instantly reports any movement of men or vehicles within a three-mile range — at night, in fog or smoke. So accurate is the set that it can detect one soldier walking a mile away and can distinguish between a single individual and a squad of several men. It is also sensitive enough to determine the approximate size of a vehicle target and indicate whether it has wheels or tracks. The new "Silent Sentry" is one main result of the joint efforts of our military leaders and Sperry to keep our defenses up-to-date.

The "Silent Sentry" (AN/PPS-4) is one of a broad variety of radar manufactured by the Surface Armament Division of Sperry Gyroscope Company.

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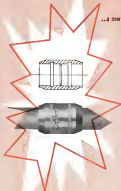
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## FLUID SYSTEM RELIABILITY DEMANDS

### BRAZED FITTINGS

...a new concept for fluid system RELIABILITY



Using this new concept offered by PARKER BRAZED FITTINGS and composed LOW-TORQUE reusable fittings, the fluid system designer can achieve high level reliability.

BRAZED and LOW-TORQUE fittings are compatible with an unlimited variety of fluids, materials, temperatures, and pressures. Connecting reliability is no longer a function of precise tolerances or displacement values. With the PARKER BRAZED FITTING, there is NO TORQUING and assembly is quick and fool-proof. PARKER LOW-TORQUE fittings assemble to a positive stop and automatically LOCK, eliminating the need for LOCKWIRING, displacement measurement, or inspection techniques. Systems designed with PARKER BRAZED and LOW-TORQUE fittings afford fluid system RELIABILITY, WEIGHT SAVING and elimination of human error in the assembly of the fluid system.

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4000 subcontractors are represented  
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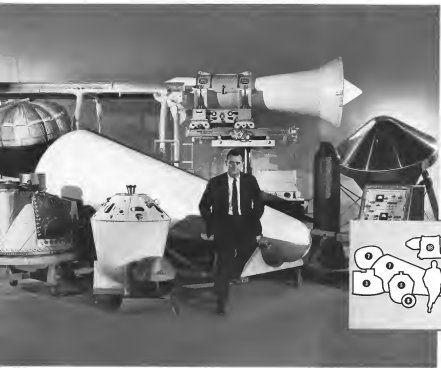
## 4 years of USAF, G.E., SUBCONTRACTOR re-entry vehicle progress

The key to this program has been teamwork... teamwork between General Electric's Missile and Space Vehicle Department, the Ballistic Missile Division and the Ballistic Missile Center of the United States Air Force and the over 4000 small and large subcontractors who have helped MSVD make an easy vital contribution to U.S. re-entry vehicle progress.

**By 1959 alone,** the following figures indicate the emphasis MSVD placed upon this important factor of subcontractor teamwork on Air Force projects:

- Over 35,000 different purchase orders were placed by MSVD on subcontractors in 1959.
- More than 35,000 of these MSVD purchases were made from "small" subcontractor businesses.
- More than \$25,000,000 worth of goods and services were purchased by these 35,000 orders. Sixty percent represented a major portion of the contract dollars received by MSVD.
- And more than \$18,000,000 of that \$25,000,000 went to "small" business firms.

If you'd like more information about G.E.'s Missile and Space Vehicle Department... its subcontracting activities, its re-entry vehicle progress on about any of its space technology activities... write to Section 155-70, G.E. Missile and Space Vehicle Department, 3396 Chestnut Street, Philadelphia 4, Pa.



At William W. Feltz, General Manager, Missile and Space Vehicle Department with Air Force re-entry vehicles designed by MSVD:

1. RV-1 Re-entry Recovery Vehicle, the largest re-entry type re-entry vehicle in travel full USAF range and to re-entry.
2. Parabolic balloon used in recovery (USA-MSVD research re-entry vehicle).
3. Recovery capsule and parachute for RV-2.
4. Reentry accelerated Re-entry Recovery Vehicle for USAF Recovery Program.
5. Mark 2 reentry vehicle which flew in their re-entry vehicle and returned for the first time since.
6. Mark 3, an advanced operational type re-entry vehicle for Atlas.
7. RV-1, the re-entry type re-entry vehicle to be delivered after full USAF range flight.
8. Mark 2, the U.S. operational heat-resistant re-entry vehicle type in use in USAF Thor and Atlas carrier.
9. Typical ground support equipment designed by MSVD for RV-1 use. (a) Mark 2 ground support circuit, (b) Mark 2 reentry entry equipment.

MISSILE AND SPACE VEHICLE DEPARTMENT

**GENERAL ELECTRIC**

A Department of the Defense Electronics Division



**THE LOCKHEED JETSTAR  
FLIES AS FAST AND AS RELIABLY  
AS THE BIG JETLINERS**

**AND PRATT & WHITNEY  
AIRCRAFT JET ENGINES  
HELP MAKE IT ALL POSSIBLE**

The new Lockheed Jetstar is the jet that goes where you want to go, when you want to go. It has unprecedented capabilities, yet can land at the smallest airports. Powering the Jetstar are four Pratt & Whitney Aircraft JT12 engines. Weighing only 1,86 pounds but developing 3,000 pounds thrust, the JT12 is one of the most efficient power plants ever developed. And it's one of the most reliable, too. Its simple, rugged design makes easy maintenance and high operational reliability. Backed up by Pratt & Whitney Aircraft's world wide service, the JT12 is an engine conceived, designed and built for business use.

**PRATT & WHITNEY AIRCRAFT**  
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To produce a useful part, most steel has to be shaped by one or more of the metal forming methods. One of these is metal cutting or machining, which changes the shape, size, or finish of a workpiece.

Alloy or carbon steels are often received from the mill in the raw form of bars, forgings, or castings. The steel is placed in a suitable machine, such as a lathe, multiple-spindle automatic bar machine, drill press, milling machine, or one of a number of other types. Metal is then removed from the steel stock until it has acquired the desired shape. This is accomplished by causing motion to take place in the sharp-edged cutting tool, or the piece of steel, while they are held in contact with each other. Cutting tools, such as drills, tool bits, milling cutters, and the like, are made from highly-alloyed steel (tool steel), cast alloys, sintered carbide, or even ceramic material.

During machining, the metal is removed in the form of chips which may be of any length, from the short, well-broken type, to the long, stringy and continuous variety—depending upon the nature of the steel, the shape or geometry of the cutting tool, the speed and feed at which the cutting is done, and the coolant or cutting fluid applied.

"Machinability" of steel refers primarily to the ease

This is the result of a series of observations dealing with basic facts about alloy steel. Though much of the information is elementary, we believe it will be of interest to many in the field, including men of broad experience who may find it useful to review fundamentals from time to time.

## Evaluating the Machinability of Alloy and Carbon Steels

with which it can be reduced to its final shape. It is measured by the speed and feed at which it can be cut, the quality of the surface finish produced, the length of time the tool will last, and the kind of chip formed in cutting. In a "free-machining" grade of steel, for example, high speeds and feeds can be used, tools will stand up well, surface finish will be good, and chips will break.

Machinability is evaluated in the shop by the number of pieces having a satisfactory finish, within the specified dimensional tolerances, that can be produced in a shift, or a day, with adequate tool life.

It can be appreciated that the study of the cutting of metals involves a large number of variables. These may be grouped in the following way:

1. Steel Analysis (Process, composition, microstructure, and mechanical properties)
2. Machine Tool (Condition, tool accessories, range of cutting speeds and feeds with ample power, etc.)
3. Type of Machining Process (Turning, milling, boring, broaching, etc.)
4. Cutting Condition (Speeds, feeds, and depth of cut)
5. Cutting Tool (Composition, treatment, hardness, size, shape, grinding and surface finish)
6. Cutting Fluid (Characteristics, application, and volume)

From this number of complex factors, laboratory tests and investigations have developed experimental data by using single variables, such as steel analysis, tool analysis, tool shapes, and cutting fluids. This information has proved to be a useful guide when machined with industrial experience, but no test method by itself has yet been developed that will indicate all the characteristics of a specific single or multiple-machining operation.

Bethlehem metallurgical engineers have had long and varied experience and knowledge in the machinability of alloy and carbon steels. They will gladly give you any help you may require in connection with machining problems.

In addition to manufacturing all AISI standard alloy steels, Bethlehem produces other than standard analysis steels, and the full range of carbon grades. Call your nearest Bethlehem sales office for information.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.  
Representative: Bethlehem Steel Sales Corporation

**BETHLEHEM STEEL**





## A black and white photograph of a hand, likely a woman's, with a ring on the ring finger. The hand is positioned with the index finger pointing down towards a small, rectangular object on a surface. The lighting is dramatic, with strong highlights and shadows, emphasizing the texture of the skin and the form of the hand and object.

Here's what he did: He put down heavy steel tracks for a series of wheeled carts. He mounted the tubes on carts, adjusted position...and, slid them together.

This ingeniously simple but unique horizontal assembly concept is yet more example of AMF production know-how in action.

AMF people are organized in a single operational unit offering a wide range of engineering and production capabilities. Its purpose: to script management at any stage from concept through development, production, and service training... and to complete these faster.

- ENTERTAINMENT PRODUCTS GROUP,  
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In engineering and manufacturing AMF has ingenuity you can use.

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 Number 817 and 818

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WOMAN'S LIFE	John W. Hain

**RADIOACTIVE NERVE SUBSTANCE**

ATLANTA 2 (201) 526-0100/0101/0102/0103/0104/0105/0106/0107/0108/0109/0110/0111/0112/0113/0114/0115/0116/0117/0118/0119/0120/0121/0122/0123/0124/0125/0126/0127/0128/0129/0130/0131/0132/0133/0134/0135/0136/0137/0138/0139/0140/0141/0142/0143/0144/0145/0146/0147/0148/0149/0150/0151/0152/0153/0154/0155/0156/0157/0158/0159/0160/0161/0162/0163/0164/0165/0166/0167/0168/0169/0170/0171/0172/0173/0174/0175/0176/0177/0178/0179/0180/0181/0182/0183/0184/0185/0186/0187/0188/0189/0190/0191/0192/0193/0194/0195/0196/0197/0198/0199/0200/0201/0202/0203/0204/0205/0206/0207/0208/0209/0210/0211/0212/0213/0214/0215/0216/0217/0218/0219/0220/0221/0222/0223/0224/0225/0226/0227/0228/0229/0230/0231/0232/0233/0234/0235/0236/0237/0238/0239/0240/0241/0242/0243/0244/0245/0246/0247/0248/0249/0250/0251/0252/0253/0254/0255/0256/0257/0258/0259/0260/0261/0262/0263/0264/0265/0266/0267/0268/0269/0270/0271/0272/0273/0274/0275/0276/0277/0278/0279/0280/0281/0282/0283/0284/0285/0286/0287/0288/0289/0290/0291/0292/0293/0294/0295/0296/0297/0298/0299/0300/0301/0302/0303/0304/0305/0306/0307/0308/0309/0310/0311/0312/0313/0314/0315/0316/0317/0318/0319/0320/0321/0322/0323/0324/0325/0326/0327/0328/0329/0330/0331/0332/0333/0334/0335/0336/0337/0338/0339/0340/0341/0342/0343/0344/0345/0346/0347/0348/0349/0350/0351/0352/0353/0354/0355/0356/0357/0358/0359/0360/0361/0362/0363/0364/0365/0366/0367/0368/0369/0370/0371/0372/0373/0374/0375/0376/0377/0378/0379/0380/0381/0382/0383/0384/0385/0386/0387/0388/0389/0390/0391/0392/0393/0394/0395/0396/0397/0398/0399/0400/0401/0402/0403/0404/0405/0406/0407/0408/0409/0410/0411/0412/0413/0414/0415/0416/0417/0418/0419/0420/0421/0422/0423/0424/0425/0426/0427/0428/0429/0430/0431/0432/0433/0434/0435/0436/0437/0438/0439/0440/0441/0442/0443/0444/0445/0446/0447/0448/0449/0450/0451/0452/0453/0454/0455/0456/0457/0458/0459/0460/0461/0462/0463/0464/0465/0466/0467/0468/0469/0470/0471/0472/0473/0474/0475/0476/0477/0478/0479/0480/0481/0482/0483/0484/0485/0486/0487/0488/0489/0490/0491/0492/0493/0494/0495/0496/0497/0498/0499/0500/0501/0502/0503/0504/0505/0506/0507/0508/0509/0510/0511/0512/0513/0514/0515/0516/0517/0518/0519/0520/0521/0522/0523/0524/0525/0526/0527/0528/0529/0530/0531/0532/0533/0534/0535/0536/0537/0538/0539/0540/0541/0542/0543/0544/0545/0546/0547/0548/0549/0550/0551/0552/0553/0554/0555/0556/0557/0558/0559/0560/0561/0562/0563/0564/0565/0566/0567/0568/0569/0570/0571/0572/0573/0574/0575/0576/0577/0578/0579/0580/0581/0582/0583/0584/0585/0586/0587/0588/0589/0590/0591/0592/0593/0594/0595/0596/0597/0598/0599/0600/0601/0602/0603/0604/0605/0606/0607/0608/0609/0610/0611/0612/0613/0614/0615/0616/0617/0618/0619/0620/0621/0622/0623/0624/0625/0626/0627/0628/0629/0630/0631/0632/0633/0634/0635/0636/0637/0638/0639/0640/0641/0642/0643/0644/0645/0646/0647/0648/0649/0650/0651/0652/0653/0654/0655/0656/0657/0658/0659/0660/0661/0662/0663/0664/0665/0666/0667/0668/0669/0670/0671/0672/0673/0674/0675/0676/0677/0678/0679/0680/0681/0682/0683/0684/0685/0686/0687/0688/0689/0690/0691/0692/0693/0694/0695/0696/0697/0698/0699/0700/0701/0702/0703/0704/0705/0706/0707/0708/0709/0710/0711/0712/0713/0714/0715/0716/0717/0718/0719/0720/0721/0722/0723/0724/0725/0726/0727/0728/0729/0730/0731/0732/0733/0734/0735/0736/0737/0738/0739/0740/0741/0742/0743/0744/0745/0746/0747/0748/0749/0750/0751/0752/0753/0754/0755/0756/0757/0758/0759/0760/0761/0762/0763/0764/0765/0766/0767/0768/0769/0770/0771/0772/0773/0774/0775/0776/0777/0778/0779/0780/0781/0782/0783/0784/0785/0786/0787/0788/0789/0790/0791/0792/0793/0794/0795/0796/0797/0798/0799/0800/0801/0802/0803/0804/0805/0806/0807/0808/0809/0810/0811/0812/0813/0814/0815/0816/0817/0818/0819/0820/0821/0822/0823/0824/0825/0826/0827/0828/0829/0830/0831/0832/0833/0834/0835/0836/0837/0838/0839/0840/0841/0842/0843/0844/0845/0846/0847/0848/0849/0850/0851/0852/0853/0854/0855/0856/0857/0858/0859/0860/0861/0862/0863/0864/0865/0866/0867/0868/0869/0870/0871/0872/0873/0874/0875/0876/0877/0878/0879/0880/0881/0882/0883/0884/0885/0886/0887/0888/0889/0890/0891/0892/0893/0894/0895/0896/0897/0898/0899/0900/0901/0902/0903/0904/0905/0906/0907/0908/0909/0910/0911/0912

ADVERTISING SALES MANAGER  
E. F. Macdonald Jr.  
STYLING \_\_\_\_\_ H. H. Ford  
EDITOR \_\_\_\_\_ A. C. Douglas

[illegible]

**RESEARCH & MARKETING**  
Mary M. Mary Parker, j.parker@uconn.edu

REWARD	
MYRTLE MANAGER	F. G. Johnson
QUICKEN MANAGER	T. J. Lacey
HOT. BUSHMAN MANAGER	M. V. Gorman
PRODUCTION MANAGER	F. A. Burt

► Project Orion enters engineering feasibility phase, solar, nuclear costs for satellites show progress

► Prospects for 14% traffic growth appear strong, trunkline per-  
centage miles may reach 32 billion.

► Certification of Pastore conversion to ISO-9001 teleprints at 80% complete. Allison Drayson will market the plans.

Space Power Systems' Elex	38	20P Regs Passenger Growth	38
Canadian Satellite Plant	39	Barlow Oiler Start Up/Ends	39
Home Approves Mortgage Funds	39	CAR Rejects Travel Agent Fees	39
Space Log Blasted in Greenham	40	Seabury Cuts Passability	40
Alaska Ship Approves Passenger	40	MTA Emergency Meet	40

Reggie Miller Ties Away	34	Wally Szczerbiak Jot Rode	45
Three Ramps Four	34	Richie Richerts Lane Hill	44
Endish Ther Six Bunkle	36	ALFA Argenti Pilot Age Cross	47
GLAF Support For RUP's Thers	41	Patric All Young P.800	38
Nord Yerts Ramps Target	42	Joe-Hunt	37
Dolores Lutz Construction Needs	48	Alison Shorrover	36

Alison Porroel, <i>Quevedo</i>	300	-	71	<b>MANAGEMENT</b>
New Serials & 14 Records	-	-	77	

Radio Spectrum for Smartphones	#1	What's Where	23
Poker Center	#6	Industry Observer	30

Musical Instruments 100 lights	87		
What's New	90		
Productive Driving	92	Column	5
New Audio Products	93	Letters	100

South American Group

**CONVEY:** Douglas Niles Zeeb, lead toxicologist supervisor, says: "food for the fourth time at White Sands (N. M.) Fawcett Ground has had forward feed modified to contain reference for salts uptake (salt) properties at top." U.S. Administration has been asked to release \$117 million augmented support program to Army for Nike Zone production (AW Feb. 22, p. 3). For other time sheets see pp. 18-19.

[illegible]



## South American Swing

We have just returned from a 15,000-mi swing through South America, a summer accomplishment in less than a day and a half total flying time that provided a remarkable demonstration of the impact jet transports will have on that part of the world and of the effectiveness of the type of person-to-person diplomacy that President Eisenhower so often talks about. The occasion was a pre-inaugural survey of Brazil Airways' jet transport service to Lima, Rio, Sao Paulo and Buenos Aires to begin regular operation in April. Pre-inaugural jitters are a routine ball-squid of the airline business, but every once in a while there is a fortunate combination of circumstances that produces an experience that goes far beyond the routine jitters. This Brazil expedition led by its deputy president, Charles E. Bond, was one of those fortunate experiences.

First, the aircraft was something out of the ordinary. We have flown in both the Boeing 707-130 on domestic service and the 700-330 on international routes, but the 707-222 piloted by Brazil is a far different beast. It is a "hot rod" version that retains the smaller fuselage and lower gross weight of the domestic 320 but is powered by the larger Pratt & Whitney JT5 turbojets of the intercontinental 330. Brazil picked this version primarily to be able to use existing airports along its route without any runway additions, but it also provides a significant speed advantage with its 625 mph maximum cruise on domestic routes plus a long range stretch of 3,500 mi on the international routes. The takeoff and climb performance of the 707-222 at high gross weights was truly startling, particularly on the climbing better than 100 degree Fahrenheit temperatures on the runways at Rio and Amazonia, and the thrust reversers left ample aircrete remaining after landings before two touchdowns.

## Contracting Flight Time

As H. M. "Jack" Bond, chairman of United Aircraft Corp. whose Pratt & Whitney Aircraft Division built the JT5 remarked, "Isn't it fun to fly in an air-powered aircraft for a change?" Brazil pilots Ted Rosen and Jack Thiesen demonstrated the long-range cruise techniques at 580 mph, speeded with nose-up tips of 1,370 mi from Houston to Lima in 6 hr 20 min and Amazonia to Pereira (3,319 mi) in 6 hr 26 min. The entire 15,128 mi cruise, plus five local demonstration flights carrying nearly 500 South Americans, was made, in the words of Ted Rosen, "without one iota of mechanical trouble." It is obvious from the way they shook South America's great distances in relative comfort, that the Brazil jets and those of other airlines and manufacturers will play a significant role in building the cultural and commercial and political closeness of the two hemisphere closer together.

Aside from the impact of its flying equipment, the trip was also notable for its vivid and unique glimpses of the continent from the air and its unusual contacts with its people and leaders on the ground. Some of the air sightings are unforgettable, the spitting white craters and speckly white line of Igua Falls on the Paraná River where Brazil, Paraguay and the Argentine meet. These 17 separate falls plunging over the rock shelf dwarf Niagara and are seldom seen from a jet transport circling 1,500 ft over the green sea of jungle. The panorama of Brasilia, the new capital of Brazil being hatched from virgin soil and of the vast country's interior, also unfolded on another low altitude descent. The wonder of this sight was again in how much already has been completed thus in the magnitude of the job still to be done.

Later, in the cool, bright summer of Pernambuco, Brazilian President Juscelino Kubitschek, with respect and understanding of the scene of his country's future westward, gave meaning to this reflection in his country's expression of its weakened frontier and left little doubt of his determination to merge its regional patterns into an integral nation.

## Shirtsleeve Diplomacy

At every stop-in the flowering oasis of Lima set in the arid deserts and mountains of the west coast in the shimmering heat of the Peruvian beauty, in the park-like atmosphere of the Argentine countryside and the cosmopolitan air of Buenos Aires, the quantity and quality of local analysts who turned out to meet this traveling group of journalists, financiers and businessmen was evidence of the word "sympathy" relation Brazil has cultivated in the same air routes and the effectiveness of its shirtsleeve diplomacy.

And, moreover, of course, in the need for expanded modern air transport greater than in the vast expanse of South America, with its poverty of good surface transport and its acute requirement to move its natural resources and raw materials to processing centers and to distribute food and goods to its population.

South America's economic development already has been aided immeasurably by the network of local and U. S. flag airlines that now has the Southern Hemisphere. More than 90% of the direct air travel between North and South America is business and diplomatic. The great North American tourist market has hardly been tapped in that direction. But, just as the 500 mph, gas-turbine-powered transport that put Europe only 24 hr from the United States stimulated the tourist boom in that direction, so will the 500-600 mph jet transport provide the impetus to open South America to a similar tourist flow.

—Robert Hise

FROM  
LAGRANGIAN  
TO  
LIFT-OFF

Sometimes forgotten during the thundering ascent of a space probe rocket are months of meticulous analysis, engineering and planning. The staff of Space Technology Laboratories is now engaged in a broad program of space research for the Air Force, the National Aeronautics and Space Administration, and the Advanced Research Projects Agency under the direction of the Air Force Ballistic Missile Division. For space probe projects STL provides the total concept approach, including preliminary analysis, sub-system development, design, fabrication, testing, launch operations and data evaluation. The total task requires subtle original analysis in many fields as well as sound technical management.

The STL technical staff brings to this space research the talents which have provided system engineering and technical direction since 1894 to the Air Force Ballistic Missile Program. Major missile systems currently in this program are Atlas, Titan, Thor and Minuteman.

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$$L = \frac{m}{2} (\dot{r}^2 + r^2 \dot{\theta}^2 + r^2 \sin^2 \theta \dot{\phi}^2) + \frac{GMm}{r}$$





Used with a ground bottle, two units on a 5-52 could save from \$1 to \$17 pounds over comparable combustion systems.

## New Hi-Lo starter system permits drastic weight and cost savings

Hamilton Standard's new Hi-Lo starter, designed to operate on either high- or low-pressure air, introduces a tremendous improvement over combustion systems — an airborne system weight ... installation and operational costs ... and practically every other factor associated with jet engine starter systems.

**Basic Design Is Simple.** The system employs a conventional Hamilton Standard MB-10 pneumatic starter, high- and low-pressure valves, and actuated starting. It is rated to start any version of J-57, J-59 or J-79 engines and operates on air from oxygen-purged or air-bottle bottles, cross-bled, and standard MC-1A or MC-11 carts.

**Permits Drastic Cost Savings.** The simplicity of the Hi-Lo system and its logistics makes possible tremendous savings

in installation and operational costs over combustion starter systems.

**Starts Twice as Many Starts Before Overhaul.** Because the new Hi-Lo system works on cool air, it has a much longer service life than combustion starter systems and actually provides up to twice as many starts before overhaul.

**Safe, Fast, Most Reliable.** Tests show the new Hi-Lo starter provides the greatest reliability and safety under any test conditions. Even if the regulating valve and blow-out disc fail to operate, and the system were directly subjected to 3000 psi, the wheel would reach approximately half its rated speed—about the same as the free-running speed permissible under actual cross-bled conditions. In addition, cool-air operation eliminates all risk of fire.

Complete technical data available on request.



# HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT

## WHO'S WHERE

### In the Front Office

**Paul D. Hilborn**, president and chief executive officer, **Radco Systems Inc.**, Cincinnati, Ohio, succeeding **Paul C. Rodigan**, who becomes chairman of the executive committee.

**Harold F. Lauer**, special assistant to the director of defense, **Office of the Director of Defense Research Engineering**, Department of Defense, Washington, D. C.

**Allen J. O'Brien**, director of traffic services, **Aerovox Industries Inc.**, Washington, D. C.

**Samuel D. Dandey**, vice president, sales and market development, **Tron Wall**, Acton, Mass.

**Ernest G. Cassano**, group vice president, tube operations, and **Harold R. Pittman**, group vice president, tanks and equipment, **Yoncos Associates**, Palo Alto, Calif.

**Alvin Ralph W. Kase**, vice president and manager of foreign operations.

**G. E. Cline**, vice president and manager of sales, services and operations, **Sun**, Fort Worth, Texas.

**H. Thomas McGowan**, Jr., director of international relations, **Co. Philadelphia**, Pa.

**Mr. H. H. H. H. H.**, president of **Standard Steel Corp.**

**Lee D. Winkler**, chairman, vice president and director, **Long-Mat Electronics Inc.**, Dallas, Tex., and **James O. Winkler**, a director, **St. Winkler**, chairman, vice president of **Chubb-Patterson Electronics**, Woburn, Mass.

**John J. Kavan**, vice president and director of operations, **The Dayton Rubber Co.**, Dayton, Ohio.

**Arthur J. Selig**, vice president and a director, **James W. Kase Co.**, Los Angeles, Calif., and **William E. Harkins**, marketing manager and **William W. Ray**, director of research engineering.

**Robert L. Vance**, vice president, operations, **Franklin Air Lines Inc.**

**Donald G. Olson**, vice president of research, **air**, **General Dynamics**, **Franklin Air Lines Inc.**, and **General Corp.**, New York.

**Robert H. Gerstman**, group vice president, processing division, **Consolidated Thermoplastics Corp.**, Franklin, Mass.

**William R. McCarroll**, vice president and marketing, **Deere & Co.**, Moline, Ill.

**Donald M. Hadd**, Jr., vice president of **Deere & Co.**, Moline, Ill.

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## INDUSTRY OBSERVER

► Components for **Tos. II**, non-flammable test reactor for Project Pluto, are being assembled at Atomic Energy Commission's Lawrence Livermore Laboratory for reactor tests at Jackson Hole, Nev. They are being built to demonstrate the feasibility of a nuclear reactor, for which Mississippi Corp. is the prime contractor. Project Pluto has definite possibilities in one vehicle scheduled to use the powerplant.

► Improved performance of the **Series of Atlas ICBM** has been achieved through a 15% increase in engine thrust and a weight reduction program. Series will have a total thrust of more than 400,000 lb. Its engine gas was cut 50% in weight and 60% in size. Its another weight reduction move, dual powered booster stages in made of smooth glass fiber material rather than corrugated metal.

► Air Force's **Atlas** refueling early warning satellite system has been placed on a program, says, but at the discretion of the Office of the Secretary of Defense. Program, however, will have No. 1 priority status as compared with the No. 1 priority now assigned to the intercontinental ballistic missile program.

► **National Aeronautics and Space Administration's** **Thor** **Atlas IV** deep space probe is tentatively scheduled to be launched by **USAF** **Minuteman** Test Center on May 4. May 8 has been set as the final hold date in event of technical problems.

► **Stratford Chemical Co.** has developed new high energy oxidizers for boost rocket fuels. Oxidizers, based on nitrogen tetroxide, have a lower cost combustion efficiency and are a major reason for success. Air Force interest is shown in **AW** Feb. 22, p. 10.

► **Acropet-General** solid rocket engines for the **Douglas GAM-75A Sky Bolt** are launched today, says are very similar to the **Minuteman** engines in concept and state-of-the-art requirements. Air Force believes the Sky Bolt can be just as successful as a missile as the **Minuteman**. First flight is anticipated within a year after the contract signing. This development procedure of staying within the state-of-the-art to achieve a short lead time, also was used in the Air Force for North America's **Hawkeye** day-launched cruise missile.

► Air Corps will be placed at the rear of production-type **Titan** ICBMs as that a strong stream of air can be forced through the first stage engine compartment to prevent heat accumulation and heating problems by leaving an air trapped behind the base of the nozzle. Tests with this configuration have shown that there is an expense in drag due to these wings.

► **Consolidated** **San Diego Division** is establishing a large electronics department which probably will address divisional status in a relatively short time.

► **Original** **night-vision** **Electronics** **Melton** **NR-500** rocket engine for **North American Aviation's** **NR-500** missile is scheduled to be delivered within the next three months. Available probably will be flown in North American test pilot Scott Crossfield's first, once or twice, with this powerplant before the plane is turned over to **National Aeronautics and Space Administration** at **Edwards AFB**, Calif.

► **USAF's** **Bolton** **Missile** **Division** has formed a "strong squad" to check on the status of various critical solid R&D programs. **Atlas** and **Titan** already have been covered, with **Minuteman** next on the agenda and the boosters phase of **Deere** scheduled to follow.

► Full scale advanced test site for the **Minuteman** solid-propellant (ICBM) at Cape Canaveral will incorporate a side wing a new construction to test some aspects of the high water table. Launch site will be surrounded by a deep, narrow to protect against water seepage.

► **Total** **Air Force** purchase of **Douglas C-119** turbo-prop transport for **Military Air Transport** is over in new set at 96 planes.



PHILCO ANNOUNCES

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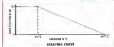
## New MADT® 2N1500 Provides Increased Power Dissipation

Here is another Philco "breakthrough" in the design and construction of high frequency, ultra high-speed switching transistors! This new Micro Alloy Diffused base Transistor (MADT) uses cadmium electrodes in place of silicon. The higher thermal conductivity of cadmium insures outstanding junctions for top gate power dissipation and provides an even margin of safety in added assurance of reliable performance.

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## Washington Roundup

U.S. and British hatched bilateral discussion of nuclear tests problem in a strained atmosphere last week. Negotiations opened in London at a time when the British are still accused over Civil Aeronautics Board delay last year in going British Overseas Airways Corp. Tokyo-U.S. operating authority. British also lack enthusiasm for the discussion because they have all the tests they want from the U.S. for now.

Route pattern on the chief item on the Barbados agenda. State Department is trying to get authority for Trans World Airlines to serve both Frankfurt and Zurich on flights beyond London. Northwest Airlines route to Hong Kong is another major item. Deadline, unless a strong prospect unless the British are willing to negotiate for other concessions in exchange for these routes.

Deadline over routes could force the negotiations into discussion of the general principles in the present bilateral. State Department wants to avoid getting into these principles because the British bilateral written in Bermuda in 1946 sets the general rules for all other bilateral. Changing these Bermuda principles would open all other agreements to change.

## Intelligence Confusion

Confusion over intelligence estimates grew last week when it became evident that U.S. officials may not all use the same estimates. Published version of the closed Senate testimony of Joint Chiefs of Staff Chairman Gen. Nathan F. Twining indicates he had not seen the intelligence analysis presented by CIA Director Allen Dulles in the Senate Space and Preparedness Committee. Twining indicated that the Senate may change. Democratic critics claim Dulles' data was contrary to Twining's testimony. Sen. Stuart Symington said the Dulles estimates of Soviet ICBM capability give the Soviet a growing lead when compared with Twining estimates, which conceded Russia a three-to-one ICBM superiority.

Dulles returned to the Senate last week to clear away the confusion. Republican members from the cloud hearing stated that the confusion arose from a serious method of presentation. Democrats were not satisfied with the Dulles explanation.

Whitney Gililand and Chan Gurney are campaigning hard for James F. Duffie's job as CAB chairman. Board veteran Gurney, a former chairman, and new member Gililand are both parking hard for the job. Duffie will vacate when the Senate confirms his appointment at a judge on the U.S. Court of Claims.

## Greater Effort

Greater U.S. effort to meet the growing Soviet military threat was urged last week on Capitol Hill. Senate subcommittee on National Policy Machinery heard several witnesses, some of them Republicans, on the external military effort is not adequate to meet the Soviet threat. They said more spending is necessary and there should be better coordination of the increased effort.

Higher spending for national security was stressed repeatedly and necessary. Boston lawyer and industrialist Robert D. Spague said it is foolish to contend that higher spending would bankrupt the country. Spague has served as a White House adviser on military affairs, and he was co-chairman of the group that wrote the Galbraith Report. This document reportedly recommended a huge defense effort, but the White House has kept it under wraps and people balked at it.

Whitman said a bigger effort would be supported by the public if it understood the military nature of the Soviet threat. Spague said the job of informing the public is up to the President, and he had the danger in some minds. Sen. Eastland has indicated Whitman College President James F. Barker III, another member of the Galbraith group, agreed that the public would support an increased effort if it understood the threat.

Quality of information used in reaching external security decisions was also questioned. Spague said top officials sometimes have inadequate or imperfect information when making these decisions. He blamed some of this information lack on the technique of getting data through bookkeeping.

## Wrapup

Authors and trackmen expect to block railroad efforts to change present laws prohibiting the railroads from controlling railroads or trucking firms. Rep. Nelson Price (D-IL), chairman of the research and development subcommittee of the Joint Atomic Energy Committee, plans to hold hearings on the status of the aircraft carrier propulsion program. CAB chairman recommends substantial expansion of Coastal Air Lines route pattern to provide most of the new service required in the Kansas-Oklahoma local service area.

—Washington Staff

























## GREAT LONDON AIR RAID SCARE

"The warning came through about 10 a.m., and I at once left the ground and climbed my Sopwith Pup towards the Thames. A signal on Bokenham aerodrome told me Huns were in the London area. Over Southend at 50,000 ft., I descended big machines in good formation flying east. As they passed, I dived on the nearest machine which bore the letters KA, and fired a drum at close range. I put on a new drum and dived from the Hun's right rear to within 200 ft., when I swerved to his rear left,

closed to 50 yards and feigned my drum. I scooted away, but the Hun still appeared to be O.K. Then I put on my last drum and repeated my manoeuvre. My tracer bullets struck all about his fuselage and wings, but caused not the desired effect. With not a moment's loss, I flew ahead of the Gotta at 200 yards making faces at him. The Hun finally put a good burst through my machine, so I flew away from the KA Gotta, whose pursuit I decided was a very nasty man!"

LEACH HERITAGE OF THE AIR—2

Such was the report of his action on July 7, 1917 by Major James T. McCudden, who was to become the deadliest ace of all British aces with 57 kills.

The appearance of Gotta G. IV heavy bombers over England marked the second phase of Germany's attempt to cross ponds in the country. The first air raid began in the evening of January 29, 1916, when Zeppelins L-3 and L-4 flew over Yarmouth and King's Lynn. Zeppelin raids continued for the next two years doing only sporadic damage. Yet they ultimately forced the Home Office to tie down 12,361 anti-aircraft troops and 12 R. F. C. squadrons with 110 planes—all desperately needed on the Somme.

As the Zeppelins proved vulnerable to bad weather, anti-aircraft fire and fighter planes, the German High Command turned to long-range bombers. The finest of these was the three-engine Gotta biplane built by Gothae Waggonfabrik, a.G. Types ranged from the G. 1 to the G. X, but the G. IV was used primarily for the London raids. Powered by two 260 hp Mercedes engines driving pusher propellers, the G. IV had a maximum speed of 87.5 mph at sea level.

On May 25, 1917, the Germans launched the first massed Gotta attack on London, but weather prevented them from reaching the city. On July 7 came the daylight raid by 22 Gottas which dropped 72 bombs, killing or wounding 594. It was this flight that McCudden attacked as it flew back to Belgian soil—out before a plane or a man.

Kills by the Gotta continued until May, 1918. Actual casualties and damage of the 52 aerial raids on England had been carefully unrecorded, but there had been a deep psychological effect. Many would remember when, in 1939, they again watched searchlights probing the heavens for planes bearing the black cross.

### Heritage of the Air

One of the most inspiring chapters in the history of technical evolution is the story of the race and flying machines of World War I. It is the highly personalized story of brave men — and the wood, wire, brass, and rudimentary technologies that converted manpower to airplanes. Today, Leach Corporation celebrates its 40th year in electronics with the presentation of this Heritage of the Air series.

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Technical Director for Heritage of the Air is Major Elmhough S. Brown, USAF

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before it became "reliability"

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## National Product Keys Passenger Growth

Prospects for 14% traffic growth appear strong; trunkline passenger miles may reach 32 billion.

By E. L. Doty

**Washington**—Prospects for a 14% growth in trunkline passenger traffic in 1969 over last year now appear strong, based upon an Airline Week chart detailing the close relationship of revenue passenger miles to the gross national product.

Using a Commerce Department projection of an annual Gross National Product of \$593 billion by the end of 1969, the chart—prepared from statistics provided by the Air Transport Association—indicates that trunkline passenger revenue miles will reach a quarterly rate of 8.08 billion by mid-1969 and an annual rate of 32 billion by the end of the year.

Remarkable slowing of heavy traffic increases during January, in the face of a rash of light scheduled airline accidents give strength to the growing forecast brought out in the chart's projections. Revenue passenger miles last month reached 2.41 billion—a figure that has been topped in only two previous months in airline history.

Optimism within the industry was slightly in the tall signposts of the chart, but a growing number of airline analysts and economists are beginning to ask heads upon this type of projection in the wake of evidence of increasing traffic growth on a short-term or one-time basis. This group also points out that the increasing impact of trunkline income passenger mile figures to the general economic scene is lessened (due in part to an increase in air traffic volume of business travelers).

#### Economic Factors

There are a few of the economic factors involved in studies of the chart:

- **Airline traffic** periodically deviates from general economic trends. This may be due to industry strikes, as in the case of the third quarter of 1954 and the fourth quarter of 1955, or to airline downturns, as in the third quarter of 1956 which followed the airline industry out of the Great Canyon in June of that year.

- **Airline activity** normally does not track closely to seasonal disruptions of the economy. Industry traffic held firm during the steel strike while the railroad was attributing 1959's decline in passenger activity to that strike. Airlines, such as Capital and Allegheny, have made gains, the high density of the steel strike will show a reaction to the strike, but the effect on the airline industry generally is unpredictable.

- **Airline passenger traffic** remains relatively stable during periods of general economic recession. In the 1954 recession, the GNP dropped below the peaks reached in 1951, but the level of airline traffic did not decline in absolute terms although it did fall below its trend in 1954. In the 1958 recession, airline traffic in some months dropped slightly below its 1957 level, but the decline for the entire year was less than 1%. The GNP reached parity in 1959.

#### Enthusiasm Off Slightly

Generally, most economists are still holding to earlier predictions that 1960 will be a boom year. However, the economists who noted at the turn of the year that base found slight dip in the relative slow pace of the economy during January.

At the same time, the forecast of a \$510 billion GNP by the end of the year has not been adjusted and a number of analysts are now noting that the steady rate expansion in January is more of a temporary boom than a permanent one. The possibility of another wave of inflation which was expected to accompany this year's prosperity.

On these assumptions, revenue passenger miles can be expected to develop in predicted way, the steadily rising expense level probably will not be as reflected in an overhaul of general aviation. As it is, most industry officials are now general to meet an impact of expansion in 1959 will come up again this year for transportation. A full assessment of the 1958 difficulties is not expected this year, but most observers agree that 1960 will not be the complacent year in the boom field that 1959 was.

Costs of maintaining jet equipment will be especially high this year, since such expenses as pilot training and maintenance subscriptions are not normally capitalized or amortized over several fiscal periods but are usually absorbed at the time the cost is incurred. As previously pointed out (AW Dec. 14, p. 38), long-term interest costs and depreciation expenses will be unusually high this year.

#### Many Variables

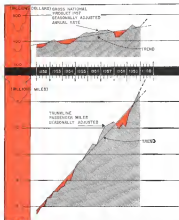
It is not entirely fair to attempt a prediction of revenue trends with any kind of degree of accuracy by relying on passenger revenue miles to give a reliable picture of the state variables involved in pricing the airline product. Only passenger traffic can be considered in any study of airline revenues since other revenue sources are not directly measured. In only a small segment of overall revenues has declined consistently in the past few years in its rate to passenger revenues even though freight volume has increased over the same period of time.

Key to the revenue picture this year—and the most pivotal of all variables—is the forthcoming decision in the Civil Aeronautics Board General Passenger Fare Investigation. If airline rates are granted some control and the benefits to take advantage of the authorized increase.

At the same time, the rate pattern will be further affected by fare adjustments designed to offset annual traffic declines which are set down by the GNP chart. Capital already has taken a step in this direction with a seasonal schedule rate it proposes to introduce between New York and most other cities on its routes.

In addition, jet overcharges may be removed this year, either through a CAB suspension or through nonregulatory action. The jet surcharge has been levied as a major factor in balancing revenues of jet operators since it represented an approximate 6% increase in revenues—some 10% in the case of airlines.

Another unpredictable variable in the revenue effect the trend toward more cash rate sales will have on one-off revenues. At present, most major carriers are taking a second reading of their cash rates in 1959 will come up again this year for consideration. A full assessment of the 1958 difficulties is not expected this year, but most observers agree that 1960 will not be the complacent year in the boom field that 1959 was.



**EXCESSIVE** OF 1954 showed a decline from the trend but the first did not drop below the previous year in the absence of 1955. The dip in revenue passenger miles in 1955 was due to airline strikes. Slow recovery in the fourth quarter of 1955 and the first quarter of 1956 was due to strikes. The Gross Domestic Product influence is reflected in the dip of 1956. Charters are strong that the first quarter of 1959 will show the same pattern due to the same volume of airline activity. On the basis of the Department of Commerce forecast of a 1959 billion gross national product in 1960, revenue passenger miles in 1960 will reach 32 billion for a 14% increase over 1958.

Since the GNP chart is a mechanical-type projection, the forecast does not include these variables. For example, in projecting revenue passenger miles in their relationship to the GNP, as thought is given to claim that the industry and public popularity of jets has generated more traffic and thus launched a new period of air travel expansion.

#### Jet Factor

Last year's traffic growth—16.7% in revenue passenger miles over 1958—gives some evidence to these claims, but it is still too early to analyze as outside the full effect jet service has had in opening new markets or making those now served by surface transportation.

Despite these variations above past years in any forecast, the chart has proved itself an accurate barometer of

revenue passenger miles in the past and can serve as a valuable guideline in analyzing traffic patterns against traffic trends and the general economy. In addition, it has proved of value in the projection of variable rate index in accordance with general market fluctuations.

#### Seasonal Changes

The chart should not be interpreted to mean that seasonal traffic trends will not dip sharply but short periods at times when the GNP remains firm or even rises. Airlines traffic steadily does fluctuate in this manner through out the year.

However, trunkline passenger miles used in the chart represent quarterly data adjusted to remove the effect of their typical seasonal variation. This adjustment permits comparison of revenue a quarter unaffected by the

lower seasonal changes seasonally experienced in traffic patterns.

Using National Product figures and in the chart for each quarter reflect "seasonally adjusted annual rates" as reported by the Commerce Department. To eliminate the effect of inflation, the series used in the chart is based on constant dollars of 1957 value.

#### Travel Agent Fare Rejected by CAB

**Washington**—Domestic trunkline attempts to offer a 10% fare discount to travel agents in sales incentive plan have been rejected by the Civil Aeronautics Board by a three-to-two vote.

The Board's disapproval of resolutions submitted for approval by the Air Traffic Conference was contained through by the two dissenting members, Vice Chairman Chas. Carson and C. Joseph Meeley, who favored holding full hearings on the resolution.

Urging approval of the ATC resolution, who would have provided a fixed rate transportation for travel agents, as well as five transportation for four members, American and Northwest Airlines and American Society of Travel Agents told the CAB that adoption of the fare reduction would promote new traffic by stimulating additional volume in domestic air travel.

In rejecting the request, CAB found the resolution in violation of sections of the Federal Aviation Act concerning discrimination and also concluded that none of the carriers submitted any factual evidence to indicate a prohibition of the ATC resolution.

Although special fares are now being provided in cases involving "extraordinary" important and special business" matters, the Board and the request for approval of the ATC resolution failed to meet that test.

While Carson and Meeley agreed with the majority votes that neither the Airlines or ASTA justified their request, they said the ATC resolution should have been brought in a full conference hearing and, if not found in ground, the CAB should have an opportunity to meet in the FAA Act to permit the reduced rates.

Emphasizing the importance of holding a means to stimulate traffic to fill the industry's seasonal and seasonal, the two dissenters and they noted the airlines' proposal is a "desperate attempt to avoid a situation of domestic travel" and a step that could do the industry to withdrawing its seat mile growth in a recessionary period of traffic growth. They added that any attempt to approve the resolution by the ATC members should make it necessary for the CAB to consider the proposal in more detail.







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SYDNEY	SAN FRANCISCO	14 HRS 45 MIN.
PARIS	NEW YORK	6 HRS 45 MIN.
NEW YORK	ROME	7 HRS 45 MIN.
SAN FRANCISCO	NEW YORK	4 HRS 35 MIN
DALLAS	CHICAGO	1 HR 25 MIN
MIAMI	NEW YORK	1 HR 45 MIN.
DENVER	CHICAGO	1 HR 35 MIN
NEW YORK	CARACAS	3 HRS 35 MIN.

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## Patterson Foresees Trunkline Mergers

Honolulu—W. A. Patterson, president of United Air Lines, worried last week that by 1963 merger within the trunkline industry will be the only solution to the financial difficulties many carriers will face as the result of growing competition for traffic in major markets. He predicted that the necessity for such mergers is as basic as the sun being visible as early as September.

The 60-year-old executive, here as last to a press flight landing United's Douglas DC-8 scheduled service between the West Coast and Hawaii, told Aviation Week that the Civil Aeronautics Board is not yet conditioned to the full need for mergers in the only way of averting chaos and confusion in the industry. He said the problem will come from the heavy air operating but does which some carriers will not be able to cure, and from the high rate of available seat miles which the pits will generate.

At the same time, Patterson forecasted the purchase of 10 Red Cross City transports, with options on 20 more to be powered with Rolls-Royce Avon Mark 511A turbojet engines at a cost of \$67 million for delivery in the spring of 1961. The Comstock purchase will bring United's total investment in turbojet aircraft and spare parts to \$185 million. This includes 40 Douglas DC-8s, of which 18 have been delivered, and 18 Boeing 729 medium-range turbojet aircraft on which delivery begins this spring.

### Additional Order

In addition, an order will be placed for 40 Boeing 727 transports powered by three 10,600-lb.-thrust JET turbojet engines (AW Feb 22, p. 49) which will bring the total jet investment up to \$175 million. The order will be placed in the early fall if the manufacturer in Mexico it will go ahead with production of the aircraft.

Boeing stated earlier that design work on the plane has been under way for two years and that a model for the first model available for service in 1961 of production work began last week.

Patterson, who is planning a 1964 delivery date for the 727s if United places an order, is convinced that there is a market for the airplane.

Patterson said financing of the equipment program has been completed up to 1959. Methods of financing to be undertaken after that time will depend upon conditions then in money markets. He said United had requested to equip position substantially during the past four years and that arrangements now being applied toward the purchase of new aircraft.



W. A. PATTERSON

On the subject of mergers, he charged that CAA's 1955 policy of strengthening weak carriers in expanding their routes is directly responsible for the strong competition that exists between carriers today. He admitted that the scramble for traffic in this highly competitive period could result in a lowering of fares by some carriers as a means of "winning in business" in flying the high volume of seats being brought about by the jets.

In this connection, Patterson called upon the Board to set "loadings and good judgment in putting on too low fares" and to encourage traffic. He said United is ready to match any rates introduced by competitors, adding that the "position of the full-time" operating each hour from field-to-field on United's jet aircraft "will be determined by the demands of the traveling public."

Patterson said that the difference between coach fares and first-class rates is now too wide when, with the light sea of passengers of the turbojet, each category of passenger carries the same speed, schedule and aircraft model. He urged the Board to study the current jet structure since the General Passenger Fare Investigation is completed.

### Dependent Transport Views

Patterson was quick to agree with claims that a supersonic jet transport could be placed into practical service as early as 1967, stating that such aircraft will be at least 12 years old. He said technological problems and local financial readjusting are involved in the use of supersonic development of the aircraft, adding that the industry must get out of its current in debtousness supporting present jet fleets before it looks to another generation of aircraft.

He said United will get increased emphasis on military contracts in an effort to obtain the company's fleet of Douglas DC-7s. Last week, the airline, said, took a large volume of charter work as a means of maintaining a high

utilization with its jetliners—most in the form of jet competition for TWA and American.

United has received its largest order for 40 DC-8s placed by Pan Am & World Air, 197 engines to include 15 planes equipped with the later Pratt & Whitney JT5 turbojet. Part of this model was used on last week's press flight which flew from New York to Honolulu in 5 hr 51 min and from San Francisco to Honolulu in a record-breaking time of 4 hr 27 min.

United will begin DC-8 service from the mainland to Hawaii on Nov. 24 with an aerial schedule of six weekly flights from Los Angeles and a five-member from San Francisco. Beginning Jan. 16, the airline will operate an eight jet on the route with 21 weekly flights between the mainland and Hawaii.

### Passenger Seating

For its Hawaii service, United has arranged a configuration of 18 first-class seats and 89 coach seats. Ticket rates include an eight seat lounge.

In designing the DC-8 interior, United called a full-scale mockup of the aircraft's fuselage to permit the best scientific arrangement of chairs, lounge and compartments.

Each of the carriers DC-8 fleet was delivered in June and service began with the JET-powered aircraft in September on the carrier's transcontinental route.

In January, the fleet, which then consisted of 10 DC-8s, had accumulated 7 transcontinental flights.

## New F-27 Orders Planned by Carriers

Hagerston, Md.—(Pittsburgh edition of Canada) announced plans last week to purchase up to 10 F-27 transport as an addition to its present fleet of three. Sales to other carriers of at least 10 of the turboprop airplanes can be announced early next month by Fairchild Aircraft Corp.

David, An Line says it may purchase its F-27 fleet from three to five aircraft, and negotiations between Pacific Western Airlines and Fairchild for the purchase of at least five F-27s have reached the final stages.

Turkish Airlines plans to buy five F-27s from Fairchild and five of the same model—designated the Fairchild F-27—from Fokker of the Netherlands.

The Turkish order, worth \$7.7 million for 10 aircraft, Fairchild said. The F-27 now is said to be 24 aircraft orders in addition, 30 Fairchild says have been sold for export use.



By David H. Hoffman

New York—Times World Airlines probably will touch off a new contest to coast speed on its Mar. 1 when it introduces the Boeing 707-111 ultracontinental jet transport on its New York-Los Angeles route and advances a 15 to 20 min. time-saving over rival carriers.

Current schedules of TWA, American Airlines and United Air Lines—the three airlines authorized to fly nonstop from New York to Los Angeles—list Mach-2.6, times of 5 hr. 55 min. with 4 hr. 45 min. coasted.

New TWA, on a route calculated to win a speed advantage, promises to cut these times to 4 hr. 15 min. without and 4 hr. 30 min. coasted by using the 707-111 to give night takeoff.

#### Maximum Cruise

TWA's Feb. 18, the 511 at maximum cruise of Mach .84 or .85. United Douglas DC-8s on coast-coast flights and American 707-111s on east coast approach use a maximum cruise of Mach .82, although American boasts that to Mach .84 or .85 on some "high competition" but shorter range domestic runs.

Fast consumption of the jets, which increases rapidly at speeds above Mach .82 and limits flight range, probably will prevent United and American from using maximum cruise power on heavily congested trips as an effort to equal TWA schedules. Coming up to 46,000 lb. more fuel than the DC-8 or 707-111 and having two to three hours more endurance, even at maximum cruise, the TWA 511 can afford to trade some operating efficiency for its speed advantage.

Publishing identical schedules from September, 1970, when United introduced DC-8s on an Los Angeles run, the three carriers up to now have started the question of speed in their advertising. All outlined that unchecked competition on the transcontinental route would boost fuel and engine maintenance costs sharply, if the DC-8s and smaller versions of the 707 were pushed beyond optimum cruise of Mach .82.

#### Stalemate

With both strictly capable of attaining Mach .90 or .91 in level flight, a three, four, or five-minute period within the industry has been credited to TWA as the three airlines reached "a tacit agreement" not to use the open lane "loophole" in their advertising campaign.

In January, however, United began

advertising that its DC-8 is enjoyed a slight speed advantage over the Boeing 707-111s of American and 707-111s of TWA, "in the area of speed alone." President W. Allen Smith wrote at United's employee newspaper "DC-8 Jet Meets the new high speed overseas jet, right initial competitive dash-off."

"Today, on coast-to-coast flights for example, this jet is faster than 707 flights operated at about the same time and under similar wind and weather conditions."

Extensive opinion was reflected in a new schedule of United newspaper advertisements that appeared during the week of Feb. 15 in cities across the country.

Stating that "When it comes to making real time coast-to-coast, performance means more than it's just faster than United's DC-8 Members," the advertisement invited arguments among flight crews and airline officials over the merits of the 707 and DC-8. Latest available performance data collected by the Civil Aeronautics Board showed that the number of United DC-8 flights reaching California since June 10 was behind schedule on about 50% of the flights at TWA and American 707s being the same routes.

#### Comparison

Here is a comparison of the three carriers' performance on transcontinental flights as planned, based on 707 transcontinental flights by "one to three minutes."

• **Westbound.** United's Flight 507 to Los Angeles arrived more than 14 min. late on 19 of 26 trips while United's Flight 461 reached San Francisco at least 15 min. behind schedule on 20 of 24 operations. This meant that less than 25% of the carrier's westbound flights were meeting schedule within 15 min. Flying to Los Angeles about 40% of American's jet trips and 35% of TWA's jet trips met schedule within 15 min. during November.

• **Eastbound.** United's Flight 503, which left San Francisco for New York 27 times, arrived late 15 min. late 22 times and less than 15 min. late six times. Only about 15% of United's eastbound flights were late less than 15 min. late at 10,000 ft. which is comparable figure for American jet 24% and for TWA 60%. One United flight from Los Angeles did not meet more than 5 min. of schedule out of 27 November operations.

Even though only one 511 jet is to be flown transcontinental by TWA, General executives in deep discussion "later" claim that its scheduling campaign at least will cut its speed. Then the carrier hopes to introduce DC-8s powered by Pratt & Whitney JT8D

(JT3) engines on its coast-coast, routes and against its competitive position.

Prime purpose in placing the 511 in domestic configurations on the Los Angeles-San Francisco route, is to allow the company to achieve top speed coast-to-coast. In addition, the plane will carry far more passengers—three hundred and two first class—than 707-111s in divided 111-seat configurations.

Automatic speed comparisons between the 707 and DC-8 series transports are nearly impossible primarily because of the number of engine/airframe combinations available to use current. Differences in cruise and climb power at high altitudes, by the carriers who complicate the picture.

#### Modified JT8D

The DC-8 is operated by United, for example, use 205,000 lb. in maximum gross weight which when equipped with modified JT3 (JT3) engines developing 15,000 lb. thrust. With the JT3-4 which develops 15,000 lb. thrust, the same lower cruise can take off at about 100,000 lb.

Climbing at constant thrust the jet transports require greater power reductions in fuel is consumed and gross weight decreases. This gives the time when cruise power can be applied to the plane's weight at takeoff and affects the flight's point-to-point groundspeed.

Douglas Aircraft Co., Inc., the DC-8's manufacturer, has admitted that its plane uses dual 707 transcontinental flights by "one to three minutes." The company feels, however, that this disadvantage will be transformed into a competitive fuel saving by an aerodynamic improvement program on the JT3-powered DC-8.

#### Program Implementation

Now being implemented at the Douglas plant this program involves the following:

- **Modifying the DC-8 wing tips.** This modification, which is being incorporated in plans on the Douglas production line, can be performed in a few weeks on DC-8s already delivered with a lot developed by the company.
- **Changing the DC-8 flap linkage.** By changing the flap slightly, a change in overall wing twist is obtained. This is expected to reduce drag and add several knots to the plane's cruising speed.

A third modification, worked out in Douglas wind tunnels, is being applied to design flight tests. This entails adding a bridge between the aileron and the wing fences at an intersection with the underside of the wing. This is expected to improve action at the joint and to assist the present vortex center of the wing, according to Douglas.

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## Slick Supports Aircraft Loan Bill Against Major Airline Opposition

Washington—Slick, Attorney General, has emerged as the most vigorous advocate of legislation authorizing government-guaranteed loans to stimulate the purchase of cargo aircraft.

The two most vocal opponents of the measure are American Airlines and the Flying Tiger Line, which, along with Slick, have a major stake in the cargo market.

The Senate's Commerce and Subcommittee headed by Sen. A. S. Moke (Minnesota-D-10) has completed hearings on the legislation, and will act on it in executive session within the next future (Feb. 13, p. 99). Moke and Sen. Stuart Symington (D-Ma.), long suspected to ally in support, in an effort of increasing military industry, are the ones there. The measure is supported by Department of Defense, Federal Reserve, American Civil Liberties Union. The two subcommittee members who attended were Sen. Charles McNair (D-Calif.) and Sen. Clark Clifford (D-Me.). Sen. Symington (D-Ma.) and Sen. George Stassen (D-Ill.), Sen. Strom Thurmond (D-S.C.), Sen. E. J. Dwyer (D-Ill.), Sen. Warren G. Magnuson (D-Wash.), and Sen. Theodore M. Burton (D-N.Y.).

At the hearings, Slick, with his cargo management plan, said for purchase of four C-130s, C-141s, C-142s, C-143s, C-144s, C-145s, C-146s, C-147s, C-148s, C-149s, C-150s, C-151s, C-152s, C-153s, C-154s, C-155s, C-156s, C-157s, C-158s, C-159s, C-160s, C-161s, C-162s, C-163s, C-164s, C-165s, C-166s, C-167s, C-168s, C-169s, C-170s, C-171s, C-172s, C-173s, C-174s, C-175s, C-176s, C-177s, C-178s, C-179s, C-180s, C-181s, C-182s, C-183s, C-184s, C-185s, C-186s, C-187s, C-188s, C-189s, C-190s, C-191s, C-192s, C-193s, C-194s, C-195s, C-196s, C-197s, C-198s, C-199s, C-200s, C-201s, C-202s, C-203s, C-204s, C-205s, C-206s, C-207s, C-208s, C-209s, C-210s, C-211s, C-212s, C-213s, C-214s, C-215s, C-216s, C-217s, C-218s, C-219s, C-220s, C-221s, C-222s, C-223s, C-224s, C-225s, C-226s, C-227s, C-228s, C-229s, C-230s, C-231s, C-232s, C-233s, C-234s, C-235s, C-236s, C-237s, C-238s, C-239s, C-240s, C-241s, C-242s, C-243s, C-244s, C-245s, C-246s, C-247s, C-248s, C-249s, C-250s, C-251s, C-252s, C-253s, 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**1.** Within the central blockhouse, 1/2" 50 ohm Styroflex® cable starts its run to the Titan launch complex 16 at Cape Canaveral...



**2.** Following along the cement wall of the concrete blockhouse loading protective case...



**3.** To the conduit that carries the high frequency cable through the massive concrete wall.

# Styroflex® Coaxial Cable

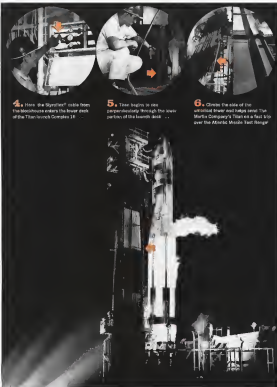
*helps put the USAF Titan ICBM into space*



The selection of Styroflex® air dielectric cable for use in the missile field was based on its superior electrical properties, uniformity, rugged physical qualities, long lengths that can be pulled up a tower without splicing and the dissipation of radiation always present in braided coaxial cables. ■ Already proven in scores of applications, including broadcast, radar, missile tracking and tropospheric systems, Styroflex® cable has a long record of successes since its introduction in Europe in 1957. ■ Next time you have requirements for a high frequency cable with low attenuation and an extremely low inherent noise level, check the qualifications of Styroflex®. Just write Phelps Dodge.

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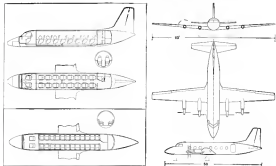






## Potez Air-Fouga P.840 Designed for Feederlines

Art's conception of Potez Air-Fouga P.840 feederliner (AW Dec. 14, p. 38), plane is powered by two Turbomeca Artouste turbojets and will carry a 5,500 lb. payload some 625 mi. at 340 mph, cruise speed. First flight is scheduled by end of 1960. Company is building the prototype with an open fuselage. Low and high density seating is shown below; note longitudinal arrangement at bottom.



## SHORTLINES

► **Alleghe Airlines** reports that over 35,000 passengers have flown the car-carrying experimental "commuter" flights between Philadelphia and Pittsburgh since the service was inaugurated Jan. 6. Of the total, 4,500 took advantage of Alleghe's special no-reservation fee at a 15% discount.

► **Federal Aviation Agency** has assigned three research and development specialists to the British Ministry of Aviation for two years. Britain is sending a four-man team to the U. S. as part of an information and personnel exchange program. The United Kingdom team will be assigned to FAA's National Aviation Facilities Experimental Center at Atlantic City, N. J.

► **KLM Royal Dutch Airlines** has begun operation of a weekly Lockheed Electra turboprop flight from Amsterdam to Baghdad via Budapest, Athens and Beirut.

► **North Central Airlines** has signed with the Civil Aeronautics Board for routes that would extend the carrier's operations into Wyoming. North Central wants to operate a route from Minneapolis-St. Paul to Casper, Wyo., with five intermediate stops in other in South Dakota.

► **Northwest Airlines** plans to trim its Douglas DC-3 turboprop flight crews at Seattle/Tarawa International Airport beginning this spring. One DC-3 will be used on a full-time basis to check out 33 crews weekly.

► **Trans-Canada Air Lines** has received authority from the Civil Aeronautics Board to extend its Halifax-Boston route to New York and to use the latter city as a terminal point on the airline's Halifax route which also serves St. John, New Brunswick, and Yarmouth, Nova Scotia. The Canadian carrier also will be allowed to operate charter flights on an off-peak basis. Trans-Canada reports it carried 1,691,800 lb. of air freight in mid-out of Vancouver, British Columbia, during 1959.

► **Trans World Airlines** plans to begin serving Boeing 707 international turboprop service from New York to Rome on May 27. The flights will increase on to Africa for the first jet service between the U. S. and Garter.

► **UAT French Airlines** is scheduling all cargo service between Paris and Dakar French West Africa. UAT will operate on a once a week basis using Douglas DC-6B aircraft.

## AIRLINE OBSERVER

► **Boeing Airplane Co.** has had out designs for a long-range high gross weight version of the 707 designated the 707-316 for West Coast Europe and New York-Mexico routes. Counting some 140,000 lb. the plane will have a 30 more gross weight over those regions than the current model reinforced 707. Production of the plane, which will be powered with two Rolls-Royce or Pratt & Whitney turbofan engines of 22,000 to 24,000 lb. thrust, will be dependent upon firm orders received.

► **Pan American World Airways** has signed a three-year agreement with Fokker International Airlines for the lease of four Boeing 707 international jet transport to be used on PAA's London-Amsterdam route. Pan American will handle all maintenance and provide flight crews for the operation of the aircraft until PAA has checked out its own crews. Once weekly service with a plane drawn from Pan American's jet "pool" is scheduled to begin Mar. 7.

► **American Airlines** and aircraft dealer Fairford B. Ayer and Associates are completing negotiating their contract for disposal of the retired Douglas DC-6 equipment (AW Apr. 27 p. 24). Overall contract included 75 of American's Douglas and Constellation airplanes. Ayer already has sold or leased four DC-6 models and 25 Constellation.

► **Market for Douglas DC-3s** ever not weaken as rapidly as originally expected since new routes and growing traffic volume are increasing load service capacity to maintain and even increase the size of present DC-3 fleet despite the addition of more modern aircraft. Like Constellation, for example, has taken an option on two additional DC-3s which it will continue to operate after five Constellation turboprops 340s are on order are scheduled into service.

► **Airways manufacturers** are expected to move quickly in the development of new automatic pilotless cockpit displays for use in transport aircraft as a result of recent operational evaluation tests by the Federal Aviation Agency, which indicate that such displays can extremely much in easing traffic control problems. Displays will show aircraft position relative to the flow of the air, using VORTAC bearing and distance information.

► **American Airlines** reports that statistics show 70% of all trips 200 mi. or more made on commercial airlines last year. Only 22% of the U. S. population has ever taken a trip on domestic airlines, 15% of all air traffic last year. 64% of all air travel. It is estimated that 80% of all air travel will be made this year by travelers who have flown before. This figure, American says, may drop to 60% during the next two to three years.

► **Douglas** considers designed to indicate collision courses in time to prevent major accidents are being built by Stinson-Carlson Division of General Dynamics Corp. at subcontractor for General Posters-Laboratories. Units will be installed in Federal Aviation Agency's experimental control center at Atlantic City, N. J.

► **Bermuda's Minister of Labor** will establish a tribunal to consider working conditions for pilots flying to Bermuda Coast multi-jet transports. British Airline Pilots Association and British European Airways have been unable to reach agreement on new working conditions. Pilots want a rearrangement of schedules to end the working day to 10 hr.

► **Boeing Airplane Co.** is now moving a 707 turboprop transport out of its Renton, Washington, plant over three days and has 15 major and four smaller positions in the 707 line.

► **Caribbean of Canada 580 jet** orders to South America has resulted from increasing pressure represented by airlines in that area. Transcontinental S. A., the Argentine private enterprise carrier with a route to New York, has dropped its order for four 580s for 1961 deliveries. Real Airlines of Brazil has reduced its order of four 580s to three, with delivery scheduled in Feb. 1961.



## Advanced Honeywell will guide high-performance

**Smallest, lightest unaided inertial system will direct complex flight path over enemy territory for scanning, mapping and pinpointing targets, and return drones to recovery area.**

The new theories and techniques of warfare call for missions that can be carried out only by combat surveillance drones that are increasingly sophisticated and recoverable for use again and again.

Under the guidance of the U. S. Army Signal Corps, Honeywell is providing for the advent of these unmanned aircraft the most advanced, versatile and accurate miniature inertial guidance system yet developed. The system enables programming to provide surveillance over several areas during each flight, and safe return of the drone to the recovery area.

Although missions include reconnaissance and mapping, the most important is target pinpointing. Here it is necessary that the inertial system of the drone be extremely precise, since the target position information the drone gathers is utilized by the remotely-guided ballistic missile which is fired on the target. Honeywell achieves such precise performance characteristics through

the use of an advanced miniature integrating gyro and pulse-noiseless accelerometers.

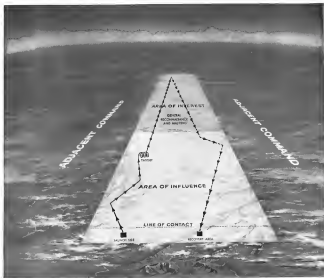
Both vehicles—the AN/USD-3 (Fairchild Engine and Airplane Company) and the AN/USD-4 (Republic Aviation Corporation)—will accomplish separate missions using virtually the same Honeywell inertial guidance equipment. The heart of this system was designed for adaptability to other navigation and ambulation requirements for Army surveillance, as well as to other inertial applications that include development for the Centaur Space Probe and the Bomarc Interceptor Missile.

Honeywell's program management approach and experience in development and production of similar equipment on several programs results in precise miniature inertial systems far less cost than is customary in the industry. For additional information on Honeywell's background in inertial guidance and navigation, write to Honeywell, Minneapolis 8, Minnesota.



**Inertial platform**, heart of the inertial guidance system. This platform is the inertial reference; not subject to highly precise GG/HR Honeywell gyroscope and GG/HR pulse-noiseless accelerometers.

## Miniature Inertial System surveillance drones



**Flight path programmed** for a typical unmanned surveillance mission is shown in this diagram. The Honeywell miniature inertial guidance system will direct the drone from launch to target and beyond, and back to recovery area without ground assistance.

**Honeywell**



*Military Products Group*





Fourth firing of Douglas Nike Zeus surface-to-air interceptor missile at White Sands (N. M.) Proving Ground was second successful, first was a failure, second was successful and third partially successful. Propulsion was furnished by tips air simulator caps for entrance for motor signals. Tactical firing angle would be near vertical and from an underground launching rail.

## Douglas Nike Zeus Missile Fired Successfully



Nike Zeus Thakel hunter (H9,000 lb. thrust) contains solid propellant (red), structure was developed by General Electric Co. Douglas supplies the most parts of the rocket engine, such as cases and nozzles. Purpose of the test flights is to explore in flight operation of the rocket motor, high temperature structural conditions, component data and aerodynamic characteristics.

## at White Sands Proving Ground







British Thor intermediate range ballistic missile is loaded into King position at the Poltwell mobile complex (AW Day 7, p. 118). Fuel pipes on at the right foreground and oxygen bottles are located on the left. Oxygen tank is at upper right, behind the missile. To date, only the Poltwell and Duffield complexes have been illustrated; both are about £10 mil apiece on the east coast of England.

## Fourth British Thor Site Nears Operational Status



Royal Air Force officers and airmen are on duty in the Poltwell Thor command van (below, left). The control van is at lower right. Each of the four British complexes house major servicing equipment and facilities for inspection and maintenance of the IRBM's. Cost of maintaining a Thor on its launch pad approximates the cost of maintenance of one British V-bomber. The missiles are usually held at 15 min. readiness but this period can be reduced.

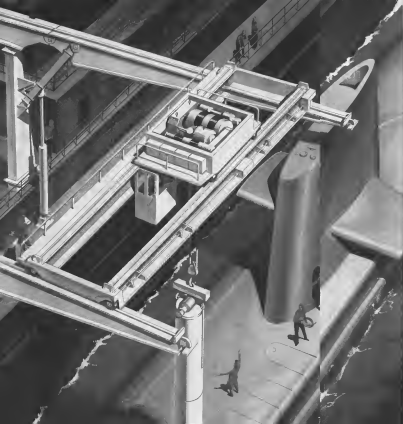


The IRBM has gone to its south-point shed on the launch complex. Note the use of a connection fitted to one in part of warhead state and checkout. Each complex consists of two squadrons, deployed at 10 min apart.

Recheckers powerplant for the Thor IRBM undergoes inspection in an RAF facility (see right). Working at the right end of its related system is detailed in a working used for classroom work (lower left). At the lower right is a view of the firing bracket, located just below the actual launch pad. Here work on last of four British Thor sites was completed Jan. 25 and the base should be operational by mid year. The 45 missiles deployed at the other three complexes already are operational. All the complexes are located on the east coast of England in the considerable range, all are used on existing RAF bases. Total strength is about 4,000 men, about one-fifth the total strength of RAF Bomber Command. Three launch pads at each site are spaced a few hundred yards apart and are covered by a total of 16 min per missile.







## Threading the needle with a POLARIS missile using Westinghouse Load-O-Matic controls

Loading POLARIS missiles from a tender into the launching tube of an atomic submarine takes a handling system that combines ruggedness with extreme maneuverability and aids, sure, precision control—control so sensitive that the POLARIS seems to float in the air as it moves smoothly and gently into position in the submarine.

Westinghouse Load-O-Matic® crane control system was selected by Royal Steel and Iron Works for this exacting and delicate handling operation because of its unerring vertical position performance. The combination of beam, bridge and trolley controls operating with almost microscopic accuracy enables the production-like weaving of the load. These precise, stepless speed controls provide movements at less than one foot per minute, yet will accelerate smoothly up to two feet per second.

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Whether your requirements for crane handling equipment—drive systems for hoisters, cranes, chutes, loaders, or shockproof equipment for hardened runs—take advantage of the Westinghouse engineering knowledge, experience, range of products and unit responsibility for any type of electro-mechanical system. Contact your Westinghouse sales engineer or write Westinghouse Electric Corporation, 2 Gateway Center, Pittsburgh 20, Pa.

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## N.D. Adds New Dimensions To High Speed Gyro Rotor Bearings!

At speeds up to 24,000 RPM precision rotor bearings in inertial guidance and navigational systems are highly critical components. Early research and development in design and manufacturing of New Departure is solving the problem and thus winning vital roles for N.D. inertial rotor bearings in missile projects for example.

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New Departure is also supplying high precision rotor bearings for the inertial guidance system in Polaris.

These bearings, through advanced manufacturing techniques, exceeding inspection and controlled environmental tests, backed by 50 years of laboratory testing experience, give precision and reliability far above the most precise industry standards. They promise new performance and reliability for the submarine-launched SSBM.

You can look to improved performance and reliability when you include on N.D. Miniature/Instrument bearing Specialists in early design level discussions. Call or write Department L.S., New Departure Division, General Motors Corporation, Trenton, Connecticut.

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**NEW DEPARTURE**  
MINIATURE & INSTRUMENT BALL BEARINGS  
*Assured reliability you can build around*

## USAF Refines Support for RAF's Thors

USAF-Douglas Thor intermediate range ballistic missile are now, again, being deployed at sites in Britain, and Air Marshal Commander's Sir Bernard Air Materiel Area (SBAMA) has assumed prime depot function for the missile system.

British Air Ministry Group, Ward told the House of Commons "As a result of test flights which have taken place in the United States, and in light of the progress made in the training program, we are now satisfied that Thor is able to take its place as part of the operational force of the Royal Air Force."

Within Flan's 1,500 cast air range are not only the major Soviet sites of Moscow, Kiev, Sverdlovsk, Minsk, Petrozavodsk, Mairinsk, and Leningrad, but nearly all of the Communist-dominated states of Western Europe which was seen Soviet aggression moves.

Crucial area probability (CRP), at that distance, in which the warhead can reach the target, is described by the Air Force as being less than the radius of destruction of a hydrogen warhead. Obviously, even much more lead within the CRP because of the missile's reliability, while the capability high, is less than 100%. Referring to Thor,

Air Force Chief of Staff Gen. Thomas D. White has declared "As recently as a year ago, 50% reliability was considered a useful and attainable objective. Today it is an amazing capability on the order of 90%."

Boost for the accuracy and reliability figures on the results of being 40 Thors with aerial operational capability. Preceding the 40 flights were 18 test vehicles which have been launched from Cape Canaveral, Fla., since Jan. 15, 1957.

### Space Booster Data

Additional reliability data has been afforded by the use of Thor in 21 applications as a space booster. While not providing data on the making of the complete space system, booster applications have added to the back ground of information on the engine and flight control system operation. Of the 21 boosters, none have been for Project Discoverer, three for Thor-Able, three for Thor-Able II, one for Thor-Able III, one for Thor-Able IV, and one for the Transit navigation satellite.

There now has a total of 51 launches including space booster applications, and the actual launch of an improved Rocketdyne NR-3 Black II engine at 757,000 lb thrust.

RAF crews are in a continuous state of readiness training and conduct regularly scheduled ground-downs, both tactical and dry. To prevent an over-reliance on the existing facilities, ground-downs, exercises are conducted from the engine.

Although the British missile area are entirely RAF-owned, a USAF officer is on 24 hr. call to release a modern weapon if such an order would not be transmitted. Orders for releasing the warhead, which would be the job of the USAF "independent officer," would come from the President by coded message sent a direct line with Strategic Air Command headquarters in Omaha, Neb.

The presence of the USAF officer largely is symbolic since the nuclear warhead itself is mounted in the crew compartment of the missile, ready to go. Need for authentication could be accomplished in the electrical circuit, but both USAF and the Royal Air Force are operating on the understanding backed by close ties that each will adhere to a standing agreement (AW July 15, p. 26).

Support for the Thor program in the area of space and operational improvement will come from the Air Materiel Command's Sir Bernard Air



Minuteman Complex at Cape Canaveral to Be Finished This Year

Workshops at Minuteman launching complex at Cape Canaveral, Fla., will be covered with sandbags. Site also includes two launching pads and two underground silo launchers. Assembly and fuel storage facilities for Minuteman will be located at a different site at Cape Canaveral. Blackboxes, 16 ft. in diameter, have walls 4 ft. thick. Minuteman complex will be completed this year.



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Manned Area at Natick AFB, Cold Flow personnel saw an in the process of being abandoned in the cockpit of a jet aircraft. Experience gained in WS-119A will be applied to other programs. Lt. Col. James C. Galt, chief program director for Thor, has already been assigned to a new program.

### Storage Units

Aside from the Thor missile itself and its transportation, a number of storage units for fuel and oxygen, guidance system and other, electrical power generating equipment, a hydraulic pumping unit, inter-mounted, landing, guidance system and electronic station, plus the wiring and piping which ties the units together.

One of the major equipment items in the special service is a computer center designed to carry Thor. The pre-stored data of the missile permits the driver of transportation from being transferred to the coast, from which launching it is launched, positioned, held down, clamped (AW May 18, p. 74). Facilities for mobile launching and maintaining the RBV's while on the operational site also were developed concurrently with the program.

RAF and USAF crews were instructed in operation and maintenance procedures of a Douglas-operated training school in Tucson, Ariz. In addition to courses covering airborne and ground support equipment systems, courses were also conducted by AC Spark Plug Division of General Motors Corp. on the guidance system; and by Rockwell Division of North American Aviation on the propulsion system. Now that Thor has been placed out of research and development, further responsibility for training has been delegated to the Technical Training Center, Sheppard AFB, Tex. A total of 1,561 RAF and USAF officers and civilian crew were trained at the Douglas school.

Operational training, still continuing at Vandenberg AFB, Calif., follows the formal classroom training. Rocket training, which calls for each crew to return from launch to the base, also is being conducted at Vandenberg (AW Oct. 28 p. 60).

Effect of the overall commitment in that sufficient personnel are trained, launch sites in the United Kingdom are ready, and the Thor is in operational form to begin.

### Thor Logistics

Operational replacement of Thor in England has necessitated the shipment of approximately 40 million lbs. of equipment a Douglas production unit. About half of this has been airlifted by the Military Air Transport Service, mostly in C-124 and C-119 aircraft. Future logistic support in the form of

space and modifications is now the responsibility of Air National Guard's 50th MA. Until recently, Douglas was responsible for shipping USAF-purchased spares to Great Britain.

Upgrading of spares stock is still under study at SRAMA and Douglas. An experience is gained with the missile in the training program and in its deployment in England, spares stock system is being continuously refined, but Douglas would not comment on whether or not any particular item is being replaced more often than in other. Spares that cannot be replaced and require no high degree of replacement. Merely they are small

items that are replaced as often as a calendar on a cycle basis. The Douglas-maintained spares stock was transferred to SRAMA in the middle of 1959.

Future of Thor in a space frontier beyond the additional 15 vehicles already loaded remains indefinite. Hans Wierst, Douglas vice president, says, "I am not for Thor in a space frontier for the next five years. With current lead time the Thor industrial complex that now exists could be kept going, he declines, with a minimal amount of production required to keep the facility alive. He would not say what this minimal figure would be.



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## Associated Aircraft Industries

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March 12, 1960



## THEY RELY ON RADIATION

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At United Chemical Corporation's Utah Division, new solid fuels are being prepared for the powerful rocket engines of tomorrow. And for the engineers who test them, a accuracy and speed of data transfer has are vital. The usual 1% error and the usual delay in processing, make a good enough. United wanted an improved accuracy of 0.1%. They got it.

Radiation designed and built the Pulse Code Modulation digital data system that system which is doing things today. It is one of the most advanced systems of its kind in the U. S., according to reliability and simplicity. It's the only system available.

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If you would like to know our representative show you a film describing the system in detail, or have a copy of our latest Capabilities Report, write to: Radiation Incorporated, Dept. 4400, Maclean, Florida. Brochure's photo are: 80 Radiation and Ordnance Research, Mission View and Pulse Mod, California.



**RADIATION  
INCORPORATED**



**SPARERS** on outer side of each Nord CT-41 ramjet change location on target from ground. Control cables are all movable. Two supporting arms on launcher swing close at 180°.



## Nord Tests CT-41 Ramjet Target

Pulse-Nord Aviation is conducting further problems in the CT-41 target missile and in perfecting the missile's recovery sequence. Production is not expected to begin until 1968.

Hoveler Satellite Corp. has signed an agreement with Nord for licensed production of the CT-41; the agreement also covers maintenance of CT-41s operational with British military units.

Flight test of the target missile (AW June 24, p. 14) is conducted at the French missile test center at Colomb-Becher, Algeria.

Nord has sold about 150 units of the series to the CT-41 target missile to several North Atlantic Treaty Organization nations, and to Sweden. A pilot target missile, the CT-10, was an other development. Nord has also sold about 40,000 unguided SS-10 and SS-11 missiles.

### Two Boosters

The two-stage CT-41, radio-controlled and recoverable, is launched by two single-stage solid-propellant boosters which burn out within 7 sec. Speed at termination of the launching phase is Mach 1.6. Maximum acceleration during launching is 10g.

Speed stage at the target missile is Mach 1.5 to 2.5. Maximum acceleration at Mach 2 cruise is 18 gms at 55,000

ft., 10 sec. at 52,000 ft and 6 sec at 48,000 ft.

The target's flight is controlled from the ground by an operator who can command left or right turn, climb or

descent, variation of Mach number, control of supplementary equipment, and recovery. The target separates into three units during the recovery sequence, which is initiated automatically if the command link fails.

Range, altitude and azimuth data is fed to a computer from a ground indicator and a transponder on the target. The target is represented by a luminous spot on a plotting unit which includes a map of the locality. Data on target Mach number and altitude is given by specter instruments. The target also can be adapted for solar tracking.

### Decoy Missiles

For launcher simulators the CT-41 can be equipped with X- and S-band transponders, launching boosters and no fuel burn. The missile eventually will be equipped with traveling wave transponders. Nord also plans to make provisions for simulation of equipment for measuring missile maneuverability. The equipment will include four channels with 150-dB coverage and a radio-distance indicator based on doppler effect.

The CT-41 has a circular portion wing, single dorsal-ventral fin and wing-mounted canards developed by Nord. Wingspan is 11 ft. 11 in., length is 32 ft. 3 in., maximum fin length diameter is 1 ft. 3 in. and wing area is 51.25 sq ft. The target with fuel weighs 2,851 lb. Wet weight at launching is 3,120 lb. The structure is constructed of light alloy, only attachment fittings and reinforcement hardware are steel. The missile can be slugged in five parts.



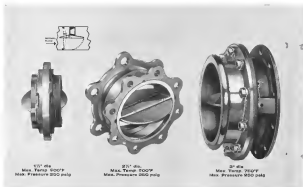
### Titan Base Construction Begins at Denver

Framework for Air Force's Martin Titan intercontinental ballistic missile base at Denver, Colo., is being built by Army Corps of Engineers. Concrete is poured into wooden forms.



# which of these lightweight **check valves** by Barber-Colman best meet the needs of your aircraft and missile applications?

On your next design problem involving air check valves, you may very likely have a ready answer with a Barber-Colman valve — either in standard sizes or special sizes and adaptations developed to fit your own requirements. Wide selection of precision butterfly . . . split flapper . . . single flapper . . . and inline types for various applications, as illustrated.



## PRECISION BUTTERFLY...STAINLESS STEEL

Combining ruggedness and light weight, these Barber-Colman precision pneumatic check valves provide positive checking of rapidly reversing high-temperature, high-pressure air surges. Typical applications include use of these valves in jet engine starting systems, compressor bleed air systems for checking flow in event of engine stoppage, and controlling air flow into a wing thermal anti-icing

manifold. These valves pass 10G vibration and feature extremely low leakage, low pressure drop. For a typical 2 1/2" unit, total leakage does not exceed 0.4 lb per minute for any combination of air temperature from 80°F to 900°F and pressure from 5 psi to 250 psi. For most combinations, leakage is less. In addition to the 1 1/2", 2 1/2", and 3" sizes shown, others can be designed for you.

## SPLIT FLAPPER

Barber-Colman split flapper type check valves are designed for a wide range of air applications employing lower temperatures and pressures. Models illustrated below are constructed of aluminum, but same general design can be produced in stainless steel for higher temperature, higher pressure applications. Standard sizes are 1 1/2", 2", and 3 1/2". Other sizes can be designed to your requirements. Compact, lightweight: 1 1/2" size weighs .45 lb, 3 1/2" size weighs .21 lb. Maximum internal leakage 1 1/2" size, .04 lb/min . . . 3 1/2" size, 0.1 lb/min.



## SINGLE FLAPPER

An economical aluminum check valve designed for low pressure applications. Typical use is checking air conditioning systems such as air. Weight .75 lb. Maximum leakage .04 lb/min at 100 psi, 300°F.



## INLINE

Barber-Colman inline check valves are designed for 1/2" and 1/2" O.D. tubing. Simple, drop-in operation, for use in servo line and similar applications. Weight, 1/2" size, .35 lb. Maximum internal leakage .05 lb/min.

## OTHER HIGH-QUALITY, LIGHTWEIGHT BARBER-COLMAN VALVES

Moisture-sealed butterfly, poppet, sliding port, and diaphragm valves are also available from Barber-Colman Company in addition to check valves described here. Write for helpful data sheets on the type valve you need, or consult the Barber-Colman engineering sales office nearest you. Baltimore, Boston, Fort Worth, Los Angeles, Montreal, New York, Rockford, Seattle.

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## Defense Lists Construction Needs

Washington—More than \$400 million, or 41%, of the Fiscal 1961 military construction program is earmarked for facilities to support the U. S. military's striking capability, including support installations for dispersed nuclear bomber units, intercontinental missiles, Polaris fleet ballistic missile systems and intermediate range ballistic missiles to be deployed in Europe.

Fred S. Beval, Assistant Secretary of Defense for Programs and Installations, told the House Armed Services Committee that other programs under the Fiscal 1961 construction budget include:

- Air defense, \$208 million, or 17% of the total program. This provides facilities for North American Air Defense Command radar networks in this hemisphere, Area and Air Force missile and aircraft defense, Navy harbor patrol and advanced command centers.

- Research and development, \$152 million, or 15% of the total program. This includes \$31 million for facilities for Advanced Research Projects Agency.

- Limited war capability, \$132 million or 12% of the total.

The major portion of the 1972 and 1973 programs for Fiscal 1961 is for the Air Force. The division is USAF, \$676 million, Army, \$158 million, Navy, \$135 million.

Original requests of the three services, totaling \$1.5 billion, were first trimmed

to \$862 million by the Department of Defense and then to \$972 million by the House of the Budget, Revenue and Finance Committee. The latter gave those details by services, on the new construction planned for the coming fiscal year.

- Ballistic missile facilities, \$197.6 million, or 41% of the total USAF program.

- Missed missile facilities for Strategic Air Command, \$68 million, or 35% of the total USAF program.

- Facilities in support of Aircraft Carrier and Warship, IJEW Line stations and 41 pay ships, \$34.3 million, 1% of the total.

- SAGE centers and other facilities for the system, \$33.7 million, 1% of the total.

- Research and development facilities, \$26 million, 8% of the total.

- Fighter interceptor facilities at various bases, \$33.2 million, 3.4% of the total.

- Naval aviation facilities at operational bases, \$17 million, 2.5% of the total.

- Research, development, test and evaluation facilities, \$17.2 million, 2.6% of the total.

- Facilities for world-wide communications systems, \$23.4 million, 2% of the total.

- Air Training Command facilities, \$13 million, 1.9% of the total.

- Air National Guard facilities,

\$187.7 million, 1.9% of the total.

- Air Research and Development Command facilities, \$9.3 million, 1.4% of USAF's total.

- Military Air Transport Service facilities, \$6.1 million, 0.9% of USAF's total.

- Technical Air Command contract aircraft facilities, \$4.7 million, 0.7% of USAF's total.

- Research, development and test facilities, \$6.2 million, 0.9% of USAF's total.

- Air Force program. This includes \$14.3 million for the Nike Zeus anti-missile missile project.

- Nike Hercules, Hawk and Minuteman facilities in the U. S. and overseas, \$26.9 million, 3.9% of the total Army program.

- Airfield and heliport facilities at major installations in the U. S. to support Army aviation programs, \$4.2 million, 0.6% of Army's total.

- Aircraft and ship facilities to support carrier striking forces, \$16.4 million, or 11.4% of the total Navy program.

- Polaris missile and nuclear submarine support facilities, \$13.9 million, 10% of the Navy program.

- Research and development facilities, \$18.3 million, 7.5% of the total.

- Missile development, evaluation and testing facilities, \$8.9 million, 6.5% of Navy's total.

In addition, \$17.5 million is earmarked for each of the services to a contingency fund for "facilities for new weapons development, new research and development activities and new system requirements."

## BENDIX REDUCES PRICES ON PYGMY® CONNECTORS!

A timely message from G. E. Steiner, General Manager, Scintilla Division, Bendix Aviation Corporation, Sidney, New York

As a result of our increased production volume, we are pleased to be able to announce that effective March 1, 1960, the prices of Bendix Pygmy Electrical Connectors, including those certified under MIL-C-26482 specification, will be reduced on all new orders received.

Reductions are as follows:

	% reduction
PYGMY-Standard Types (solder type contacts)	approx. 4%
PYGMY-CE Series (crimp type contacts)	approx. 4%

At a time when price increases bid fair to become the order of the day, we are taking this step toward helping to reduce military and commercial equipment costs. It is in line with our policy of always offering our customers the best product at the lowest possible price consistent with efficient design and manufacturing practice.

*G. E. Steiner*  
GENERAL MANAGER

Scintilla Division

Sidney, New York



Rocket Sled Tests Minuteman Guidance Components

Whitcomb SCRM guidance components as tested at Holloman AFB, N. M., on USAF rocket sled. Type AJ10 sled is powered by three-thruster system supplied to USAF by Aerojet-General under a subcontract from Calspan Engineering Co. Propellant system has a total thrust of 114,000 lb. and accelerates at 116g to 1,600 gph. Thrust chamber is oxygen-fueled, stainless steel and air not fitted with cooling equipment. They burn 4,600 lb. of propellant in 8 sec. Propellants are oxidized red fuming nitric acid and a combination of hydroxy but and symmetrical dimethylhydrazine. Tests are run to calibrate acceleration-sensitive devices that measure Minuteman's velocity, and to determine environmental stability of guidance components. Without its nose section the sled measures 35.25 ft. long. It weighs 14,200 lb. fully loaded.



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**AC Seeks and Solves the Significant**—With GM's support, AC is taking giant strides toward leadership in the international technological race. And AC Reliability—characteristic of every aspect of AC's operation—plays a large role. It results in such successes as AChiever inertial guidance for Thor... and the more sophisticated AChiever being built for Titan. / This is AC QUESTMANSHIP. It's the scientific quest for new ideas, methods, components and systems... to promote AC's many projects in guidance, navigation, control and detection. / To Mr. Harold C. Vost, AC Director of Reliability, the goal of Questmanship for his group is "to find ways to make a product able to repeat its performance". They constantly seek product improvement, "making creative contributions in every area from basic design to field operation". That takes engineers with broad knowledge, imagination and experience. / You may qualify for our specially selected staff... if you have a B.S., M.S., or Ph.D. in the electronics, scientific, electrical or mechanical fields, plus related experience. If you are a "seeker and solver", write the Director of Scientific and Professional Employment, Mr. Robert Allen, Oak Creek Plant, Box 746, South Milwaukee, Wisconsin.

**GUIDANCE/NAVIGATION/CONTROL/DETECTION/AC SPARK PLUG** See Electronic Division of General Motors

## AERONAUTICAL ENGINEERING



CONTOUR of output Convair aircraft, below thrust line is altered in conversion, as is the fuselage front fuselage.

### FAA Tests Allison-Powered Convair 340

By William S. Reed

Since Mexico, Calif.—Performance capabilities of the Allison turboprop powered Convair 340 are being demonstrated in the final series of Federal Aviation Agency certification tests being conducted by the Federal Aviation Corp.

FAA is converting Convair 340 and 440 transports to a Super Convair configuration for Allison Division of General Motors Corp. study in reducing the conversion to achieve equal area and constant thrust engines (AV Feb 8 p. 45). Last Super Convair delivery will be made soon after final certification test 30% complete with certification to be reached Mar 71. Test results, N1100 will be received by Allison as a demonstrator.

FAA's manager of flight operations, J. H. Cove, demonstrated the Super Convair's performance by changing to 20,000 lb of the maximum gross weight of 52,200 lb. The conversion, which involves, riding in the pump-out, ducted the turbo-climb on a dry flight, current test standard, at 15 min. This is better than Allison's previous

With the Allison 501-D13 turboprop engine, it is shown that thrust will increase (N1100) of 971C. Cove reduced the thrust and the aircraft at elevated speeds, retrieval started at about 90 ft. Initial rate of climb provided the 2,000-lb. rate of the test reduction on the prop.

#### True Altitude

As speed stabilized at 232 kt. indicated speed at 20,000 ft. with an indicated fuel air temperature of -18C. Engines were not back to normal cruise setting of 940° MKT (540C). Cruise power was stopped with these, since noted data is 750 kt., which compares with Allison's guaranteed standard-day TAS of 300 kt. at 45,000 lb. gross.

Following a standard engine failure to check the automatic engine torque signal, the left propeller was feathered and the right engine advanced to maximum continuous (MCR) (532C). The aircraft sustained 70,000 ft. with no speed stabilizing at 174 kt. 145.

Acceleration from 140 kt. 145 to more than 180 kt. while maintaining 1,000 ft. altitude showed that sufficient elevator control is available to overcome the destabilizing effect of the

reversed engine horsepower. Control, stable elevator time is required in speed build up, but automatic elevator and horizontal stabilizer were possible single stages.

Landing weight was in excess of 52,000 lb. (certified maximum is 48,500 lb.) before a single engine landing was not demonstrated. Single engine landing steps, wing full reverse, thrust on one engine (MCR) power have been executed previously. Cove said.

At the conclusion of the flight, full reverse thrust was used on both engines, resulting in a very short roll despite the heavy landing weight. Brakes were not used.

Extensive automatic modification is not necessary since the Convair 340/440 aircraft are designed to accept the Allison turboprop's higher thrust power. Using a power turbine is an other advantage, Allison contends.

Convair spokesman told Vectors West that since 1965 now have logged each 20,000 lb. in active service. The company is reluctant to predict what the service life of the turbine will be. Longue runs on the 140/440 structure have failed to yield a prediction also running into cycles equal to "new











## THE NAVY'S POLARIS:

### DONNER *helps it think...*

One day soon the U. S. Navy will fly a report more fantastic than any sea serpent tale we've ever heard. This will be the launching of the Navy's spectacular Polaris missile from a submerged nuclear submarine. Advanced testing is underway; the Polaris will be ready for the fleet in 1960.

Swifter and lighter than other intermediate range ballistic missiles, this formidable Lockheed developed weapon features much that is new in advanced electronics. It even "thinks" for itself.

One such "think" device aboard the Polaris is a system developed by Donner Scientific Company using as a base a standard Model 4310 Accelerometer. The system monitors flight performance like a policeman directing traffic. If, for example, in the initial portion of the flight, the missile does not achieve sufficient velocity by a pre-determined time, the Donner system shorts the flight. The missile gets the go-ahead only as programmed.

Donner's role in the Polaris project represents another basic contribution from an engineering team which specializes in accurate systems, interlocking time, acceleration, velocity and other inputs designed to select customers' requirements.

Donner welcomes your inquiry concerning the company's capabilities in this and related fields. Write Don 002.

**DONNER SCIENTIFIC COMPANY**  
Concord, California.

long effort of increasing engine power by 50%. Packers are using the engineering and design work done by Constar on the magazine when the YC-119 military version was converted to use the Allison T-56 engine, which has the advantage of the J44-D11 power plant (AV Oct. 12 p. 37).

- Engine instrument panel and new control pedestal also are added. In addition to the thrust lever, conversion includes a fuel shutoff lever and a fuel valve light panel on the pedestal, panel instrument—altitude, fuel/boost, target meter calibrated in horsepower, turbine inlet temperature gauge and pressure and temperature gauges, all quantity gauges and recirculated fuel quantity gauge.
- Fuel system overhaul. Original fuel tanks are used but new fuel lines are installed and re-welded. Original fuel booster pumps are retained and fuel quantity gauges are re-calibrated for P-4.
- Fuel conditioning system uses filters from another.
- Hydraulic system. Instrument panel is retained and new engine-driven hydraulic pump is attached on the left engine. Modifications of the compressor on the right engine preclude installation of a second engine-driven hydraulic pump and added hydraulic power is derived by one A/C and one D/G hydraulic pump.
- Electrical system's engine-driven A/C generators are retained. Additional electrical power is supplied by two engine-driven 40-hp alternators. A standby generator also is retained for fuel instrument operation should both alternators fail.
- Exhaust system's engine-driven A/C generators are retained. Additional electrical power is supplied by two engine-driven 40-hp alternators. A standby generator also is retained for fuel instrument operation should both alternators fail.
- Cabin pressurization system uses a new. All-weather both engine-driven turbine on the right engine, feeds into the plane's standard system installation.
- Hot wing and tail are fitted with the 144 compressor stage. Engine inlet, propeller hubs and spinner are covered with Spentex for chemical protection. Additional cabin heat, other than that derived by the heat of compressing the air, is obtained from A/C or electric heater.
- Second treatment of cabin includes adhesive foil on the inner skin surface of the 140 aircraft to add heat for sound proofing. Soundproofing also is added at the place of the propeller. No additional treatment is required on 440 aircraft.
- Starting system employs a gas turbine compressor in the right nacelle, making the aircraft independent of ground power for starting.

**Optional Items**

Optional conversion features consist of two integral tanks in the outboard wing section, adding 150 gal., and 680 gal. of wing tankage amount of engine

### New B-18 Records

Mooney-Sweet system officials say the first sublogging B-18 transport recently established five new world records.

The B-18 earned a 10 metric ton payload over a 5,000-lin. closed course at an average speed of 490.9 mph, averaging to Sweet officials. The 7 hr. 14 min. flight used four Mooney work to be transported in the Coconino, northwest to Sweet look in the Utah mountains and back to Mooney.

New world speed records claimed on the 5,000-lin. distance sufficient load and with loads of 1, 2, 3 and 30 metric tons.

Two other records have previously been set by the B-18. Last August, a "Mooney" sublogging earned 13 metric tons over a 2,000-lin. closed course at an average speed of 447 mph. The Nov. 28, it B-18 lifted a 20 metric ton load to an altitude of 19,370 ft.

mooney. At the time of conversion, an all-AC electrical system can be added at extra cost.

Engine arrangements and wiring configuration is at the option of the customer and is subject to negotiation with Packets, independent of the conversion contract with Allison.

An exchange program is offered by Allison whereby the customer returns a used QEC pack, propeller or wheel seat to the factory, in great a replacement unit and is charged for the cost of overhauling his returned unit. Allison and Allison also agree to maintain, service operations for engine and propeller overhaul and line maintenance work on even of a fixed wing per engine fleet flight time. A similar arrangement, subject to individual contract negotiation, can be made with respect to aircraft operation.

### Overhaul Sites

Allison and Allison also have had 104-D17 engines, 680 propellers, Fleet QECs and powerplant accessories at factories in Indianapolis, Ind., and Durban, Ghana, for all U. S. aircraft operations. Flightline, Allison says, facilities will provide complete service for all Super Constellation aircraft who that the system.

Allison warrants the modified portion of the Super Constellation aircraft for 1,000 flight hours or six months whichever comes first. The company also offers flight instruction in the converted airplane and operation and maintenance instruction on the engine and propeller as part of the suggested contract price.

Conversion is planned to continue reporting the unmodified portion of the 140-440 aircraft in long to 35 aircraft of the type, either piston or turboprop are operating in active service.



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A lot is happening in "Teflon" today. To keep you up-to-date, "Teflon" with the R/M non-bondable of R/M's new "Teflon" service that can help you improve design and increase productivity even while reducing costs. Call one of the offices listed below or write Plastic Products Division, Raybestos-MANHATTAN, Inc., Manhattan, N.Y.

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# RPC-4000 ELECTRONIC COMPUTING SYSTEM



The RPC-4000 is a new, fully transistorized electronic computing system with the largest memory, greatest problem-solving capacity and flexibility in the low-to-medium-priced field. It is the latest member of a growing family from the people whose LEP-30 has become the world's leading small-scale computer.

Wide range of applications: the RPC-4000 has been designed for engineering, scientific, business data processing and management control functions. Such jobs as product and process design, statistical analysis, research inventory control, payroll and sales analysis are all well within its capabilities.

Easy to use: the RPC-4000 is simple to program and operate. Read-Matrix computing and translating routines allow even non-theoretical personnel to obtain maximum results. Versatile simulation structure gives programming speed and flexibility.

Available at low cost: high capacity, flexibility and ease of operation make the RPC-4000 the outstanding computer value on the market today.

Minimum operating costs: the RPC-4000 requires no air conditioning or special maintenance. It is powered from any ordinary wall outlet.

Outstanding assistance: users benefit from free training, an information-exchange service, and library of programs.



Heart of the RPC-4000 system is a new transistorized computer with advanced design concepts that provide substantial computing speed and capacity in a low-cost unit. Magnetic memory drum stores 4000 words. Operating speeds are as high as 330,000 words.

Standard input-output is a tape-to-tape system which includes a Royal Electric recording drumless recorder complete with disk and drum, plus a tape punch and reader. Read speed is 60 characters per inch, read speed 24 characters per inch. Tape reader, punch and reader can be interconnected in two configurations for both on-line and off-line operations.



A new 280 character-per-inch, photo-alloy tape reader and a 300 character-per-inch punch are available as optional input-output equipment. A magnetic tape unit and a line printer will be available soon. An input or RT input-output device (280 with reader modification) may be substituted on-line to the built-in system. All peripheral equipment is under automatic program control of the computer.



**Royal Precision Corporation**

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. RPC-4000 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing Division. For full, detailed information on the new, transistorized RPC-4000, write **ROYAL MCBEE**, data processing division, Fort Chester, N.Y.



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The high temperatures encountered with supersonic speeds are carefully simulated in Woodward's newest environmental testing facilities.

Here, complete fuel controls for jet engines are thoroughly tested in ambient temperatures up to 500° with fuels heated to 400° and hydraulic fluids up to 600°. The probe of the control's temperature sensor is checked at 800° ambient temperature.

Environmental testing at Woodward does not stop with the safe handling of fuels and fluids at high temperatures. From the 800° maximum, temperature is carefully controlled down to 60° below zero to study a variety of other fuel control problems... the effects of unpropagated expansion and contraction of dissimilar metals on temperature shifts... sealing problems... some problems caused by condensation in fuel at low temperatures... tests in which controls operate on fuels contaminated with additives like nitrous fluid, salt water, wet acids, organic fibers and sulphuric acid.

Life tests are also conducted to establish the endurance limits of complete controls, assemblies and parts.

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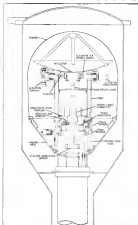


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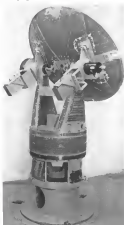
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## AVIONICS



TRACKING HEAD of electronic sextant is almost fully assembled (right) in laboratories of American Standard's Military Products Division. Drawing (left) shows details of the tracking head secured by plastic rubbers within an extensive ship's subassembly mast.



## Radio Sextant Developed for Submarines

By Barry Miller

Newport, Mass.—An electronic sextant capable of correcting mental navigational mistakes of Pacific coastal submarines is nearing completion here in the laboratories of American Standard, Military Products Division.

Essentially a radio telescope designed for undersea operation, the sextant will lack an X-band radio connection from the mast, the sea is ultimately other than border the sea and will provide corrections for errors due to gyro drift in the ship's inertial system. The combination—ship's inertial navigation system and the electronic sextant—will provide Pacific submarines with an accurate, all-weather navigational capability.

In addition to the instant American Standard engineers are putting the finishing touches on a second navigational aid, the one known as a Type 11 periscope. Inherently of greater accuracy than the sextant but restricted to clear weather use only, the periscope enables an operator to visually locate a target position and manually enter information which corrects the sextant system's perfection of the ship's position.

### Retractable Mast

Operation of these complementary aids requires, however, that the submarine rise to a retractable shallow depth from which other a retractable mast bearing the sextant's antenna or the Type 11 periscope can be extended above the ocean's surface.

Besides all-weather capabilities, the radio sextant type of device, American Standard engineers say, has another feature of military interest—it is extremely difficult to jam. To disrupt this system, large bursts of energy must be generated on a line of sight between the antenna and the external body on which the overall measuring line is taken, precisely where it is taken.

American Standard has orders to build only one version of the sextant, but funds have been allocated for other versions to go into the measuring Pacific submarine. At least one firm is currently running a radio sextant design study and another—Collins Radio—like American Standard, has previously designed radio systems for surface vessels.

Under a \$5 million Navy contract,





## Crosley Amplifiers— Under The Polar Ice Cap

Today's Navy calls for reliability. New submarines and surface ships demand reliable capacity in every phase of development. When amplifiers used in underwater torpedoes fire-control systems failed after a few hours of operation, the Navy turned to Avco's Crosley Division for help.

Crosley engineering solved the problem. The product: an amplifier that operates without failure for 2000 hours or longer.

Recently the Navy decided to install Crosley amplifiers in fire-control systems aboard many of its modern vessels—including the nuclear-powered submarines SS (N) *Nautilus*, SS (N) *Starline*, SS (N) *Daguerre*, and SS (N) *Swordfish*. When the *Starline* made its historic journey under the Arctic ice cap in 1958, it had Crosley-made amplifiers aboard. Today, some ten different types of Crosley amplifiers are used by ships of the U.S. Navy.

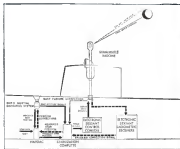
Crosley's talent for design, engineering, and manufacture of transoceanic amplifiers has earned an important place for this critical equipment. It is reflected in airborne television gun-sighting equipment purchased by the U.S. Air Force, in the huge F2H-36 night fighter radar for perimeter defense, and in the Navy's Polaris missile system.

For more information on amplifiers designed and produced by Crosley, write . . . Vice President, Marketing-Defense Products, Crosley Division, Avco Corporation, Cincinnati 26, Ohio.

AVCO, CROSLY EMPLOYED EQUIPMENT TO DESIGN AND MANUFACTURE

**Avco** / **Crosley**

Over 100 different types of amplifiers designed by Avco/Crosley for use in submarines fire-control systems



**RADIO WAVES** from the moon are used in existing inertial systems to determine where ones exact position to safely make launching ready. Radio waves indicate how exact is told into day's inertial navigation system. Electronic system will gradually take time to use in moon even as does with lunar clock every

where in coordinates are converted back to earth coordinates, sent to the NAVDAC computer from which coordinates are then directed into SINS. The NAVDAC computer also receives considerable information from the Type 31 periscope for correcting SINS.

The Polaris electronic system evolved from the first order Navy needed work with Enco-Knight on a radio-sighting system for surface vessels especially suited to launch lighter missiles. For the project, Enco-Knight developed an 8-line tracking wave tube video telescope receiver combined with a 25 ft antenna which was able to receive signals from 12 radio stars.

At its peak, American Standard came up with a ranging four-star waveguide, gain, and a non-linear receiver system. A gyro-electronics package on the antenna pedestal generated a true vertical to offset structural distortions of the ship's mast.

In January 1958, the Navy awarded the original contract and told contractors to reflect their work for antisubmarine operations. This required accurate reduction in the antenna reflector flux having reception to signals from the moon and the sun. In addition, it was necessary to find ways to:

- Support the antenna over the surface;
- Exclude sea water from the antenna and the RF tracking component;
- Measure the attitude of the antenna beam-of-sight with respect to a north-star reference within the submarine;
- Accurately transmission of RF energy



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- Warhead Design
- Shell System Design
- Miscellaneous Electronics
- Assembly Design
- Projectile Design

For complete information, write or call Mr. P. B. Oline, Manager of Scientific and Administrative Personnel, Dept. W-10, Crosley Division, Avco Corporation, 2100 Lehigh Street, Cincinnati 21, Ohio. Please, K-44-2-4070.

**Avco** / **Crosley**



from the antenna into the radome.  
A standard solid tubular mast sleeve 35 ft in length was utilized for the antenna support. In its retracted position, it is stored within a sealed tank in the ship's storeroom.

A rigid reinforced plastic radome, 4 wadually in thickness, covers the existing mast which consists of the antenna and antenna drive motor. The radome was selected to have small enough reflections of RF energy to get unimpeded accuracy and of sufficient strength to withstand wave impact force. A quartz window at the base of the mast permits entry of scanner into the mast.

The two-way tracking head with motor is mounted atop the mast. A flocan scanner indicates how much the mast heads with motor drag and rolling and pitching of the boat and supplies correction signals to the ship's stabilization computer.

In the flocan scanner system, a beam of light is projected from a telescope at the base of the mast and is reflected from a mirror on the tracking head base and reflected as a detector in the telescope. This provides the exact for measuring the tilt of the top of the mast. The flocan scanner is a two-way automatic autopilot and incorporates an optical relay, a box with mirrors on its four vertical sides, that serves as the basic reference to the ship's coordinate system.

#### Antenna Transmission

To assure transmission of RF energy through the mast into the motor, the best low-loss transmission lines were selected. Efforts are being made to reduce and prevent reflection points on the lines. As indicated previously, one of the antenna and sensitivity of the radome antenna have external receptors to the mast and the sea. The mast is preferred because it is more stable, unobstructed. This mast can be changed if power availability can be improved. Presently, the antenna complex traveling wave tubes but is intended to be convertible to wideband. A Vane with 100 wac bandwidth would be necessary to equal the performance of the antenna with tracking sea tubes.

If a more sensitive antenna were designed into the system, it is likely that the antenna dish would again be referred to focus the built on the mast. The present system is said to be a fair balance of antenna size, cost and accuracy sensitivity.

Ever-Knight currently has a separate offshore drier contract from the Navy which covers the study of absolute permeability-Maxwell and parametric amplifiers—from which better devices

for increasing system sensitivity may emerge.

The antenna's submillimeter receiver will be at least as sensitive as a standard submillimeter which is capable of detecting 0.18 mcm long-wavelength, delinquency.

A subsensor for Ever-Knight and Besides Ever-Knight, the firm working with Military Products Division on the system and the team they supply include: Brown-Boveri-California Co.—the radome; Edco Corp.—the mast; Altek Research Associates, Inc.—the radome hydrodynamic tests; Perkin Elmer Corp.—the flocan scanner; Egon, Inc.—the submillimeter computer; and Advanced Technology Laboratories Division of American Standard—environmental controls.

Aside from its responsibility for design and integration of all parts into the system, the Military Products Division handled the tracking head service, the tracking electronics and the control console.

The Military Products Division of American Standard has been active in many submillimeter, coordinate transformation computers and precision navigation computers for the past 12 years. Originally known as Control Engineering Corp., the firm was acquired in 1955 by American Receiver & Standard Security Corp. as a unit of its Detroit Controls Corp. It has since evolved into a separate division of American Standard specializing in computers, as guns, accelerometers and electronic navigation computers.

#### 44493 FILTER CENTER 3444

Low-Cost DMCT Reports Available—Quarterly progress reports on a Federal Aviation Agency-sponsored program to develop a minimum-cost distance measuring equipment, ready now at National Aeronautics Corp. (NACA), are available to service equipment manufacturers who may be interested in manufacturing such equipment. Requests should be directed to Bureau of Research and Development, Federal Aviation Agency, Washington 25, D.C.

New Firm To Exploit Volo-Sec—Applied Communication Systems is the name of a new firm formed to assist industry in application of new Volo-Sec technique, developed by Hughes Aircraft Co., which speeds employee training, slashes defect rate and increases output (ENR Jan. 4, p. 75). The new firm, a division of Science Research Associates, Inc. of Chicago, is headed by Donald E. Stewart, who formerly headed the Hughes Volo-Sec project. Applied Communication Systems address is 8515 Warner Drive, Culver City, Calif.



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## EQUIPMENT

### Idlewild Installs IFR Narrow Gage Lights

By Barry Tully

New York—Improved traffic handling of jet and conventional aircraft under instrument flight rules at New York's Idlewild Airport will result from the commissioning of Runway 4R as an instrument runway at a cost of \$9.2 million.

Runway 4R, 21L, at Idlewild, equipped with narrow gage and centerline lights and high speed ends, became an instrument runway last week following Federal Aviation Agency installation of approach lights at its southwest end. The 6,400-ft runway, in landing use during visual flight weather conditions since October 1970, will be fully instrumented in both directions sometime this spring.

The commissioning of 4R, 21L, as an instrument runway, gives its users the west, 4L, 21R, for takeoffs. This takeoff runway will be extended 600 ft to the southwest and 1,100 ft into Runway 4R for a total length of 12,600 ft. If takeoff performance remains constant, the increased runway length will provide greater safety margins in the event of short or wet pavement trends to reach higher altitudes while within field boundaries, thus lessening noise problems.

The added length also could be used to increase allowable takeoff weights.

The instrument runway, 4R, 21L, is the first conventional airport runway to couple flash-mounted narrow gage and centerline lights. These innovations are combined with flashing strobe approach lights, dual ILS, and lighted high speed turnoffs.

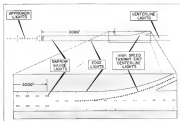
#### System Tested

The narrow gage lighting system, designed to eliminate breakdowns in the so-called "black hole" of conventional lighted runways, was tested at Dow AFB, Me. (AW Dec. 1, 1968, p. 76). A second Air Force installation of the system is at March AFB, Calif. At both Dow and March the flash light system is used in Runway 8-12 boundaries with heavier landing weights than conventional jet instrument use, flying.

The narrow gage lights—the 6-ft gage approach section, to pilots in comparison with conventional lights in the runway perimeter—are placed at bar trends of three, 30 ft down the center line, at 100 ft intervals down the runway. This double row extends for 1,000 ft from both ends of the runway. The remaining center section is lighted by a



APPROACH and ends of Runway 4R light Idlewild's new instrument runway, shows approach lights in center line and high speed ends to the left of the 6,400-ft strip. The four high-speed ends (one per landing direction), present trends at 1,000 ft, or 574 ft, at pilot's speeds to 60 kt.



LIGHTING configuration of Runway 4R, 21L, is shown in detail. The narrow gage light lights extend 1,000 ft from each end of the runway with centerline lights covering the remaining 2,400 ft distance. Enlarged insert shows the location of the flash strobe lights (black dots) which lead the pilot through the high speed ends of sight.





### Gentry Welders Used in Redstone Production

With welding of the qualified Redstone shells to be used in the Project Mercury program, suborbital flights is accomplished by means of two gentry welders on 180 ft tracks. Welders, developed by the Reynolds Metals Co., Sheffield, Ala., permit welders to shape the dovetail shells before the gentry is rolled into place.

single row of lights on the controller.

The lighting system, as seen by a pilot on landing approach, appears as a narrow strip of white lights centered between the runway lights. If the aircraft is not aligned with the center of the runway, just one row of lights will be visible. Correction toward the single row will bring both rows into view, indicating alignment with the centerline.

When the aircraft is over the runway, the pilot touches down on air between the narrow row lights rather than settling in on runway without narrow row lights, into a dark area between the edge lights. The flash lights present a textured light surface which is intended to aid depth perception.

### High Speed Brakes

High speed cars on runway, 48,721, loaded at 1,131 lb and 5,710 lb from each threshold, permit taxiing at speeds to 60 ft. The cars have a turn radius of 1,500 ft and retract the runway at an angle of 16 deg. At night, white parallel lights, each mounted at the runway at 20 ft intervals, lead the pilot from the runway centerline through the high speed cars.

The flash light fixtures used for the runway and centerline lights are produced in Shurtland Concrete Products Corp., New York. The steel fixtures, called Eklids, are a Dutch design perfected by Shurtland Concrete. The Eklids are an aluminum steel base ranging from 6 to 10 ft in width, 8 ft in

length and 12 in deep, oriented lengthwise along the runway.

Each Eklid unit houses one or two General Electric PAR 16 (parabolic aluminized reflector) lamps. The fixtures are covered by a hood and guide capable of surrounding direct support landing loads. The forward half of the Eklid is made up of a series of flange, corner channels, through which light is transmitted toward the oncoming planes.

The 100-watt PAR lamps are capable of producing 90,000 peak beam candle power at maximum rated current of 70 amp. This degree of brightness would be required only under maximum visibility conditions. For use as better weather conditions, four lower degrees of brightness may be selected by the control knob. The Inverted Housing Department of General Electric, Schenectady, Ind., developed a 1,500-watt beam unit for the flash lights for clearing.

### Tabular Lamps

Flash-mounted runway lights, also produced by Shurtland Concrete, utilize General Electric's "Quartzhalo" 40-watt lamps. The small tabular lamps are expected to generate enough heat to melt snow and ice eliminating the need for deicing liquids. The circular quartz fixture isn't a fill in its diameter and two less than 1 in. above the runway surface. The "Quartzhalo" lamp is covered under a protective steel plate and its light shines out through two



### SIMULATORS—BASIC TOOLS IN VOUGHT RESEARCH

The Manned Space Flight Simulator Laboratory shows operators in designed to answer difficult questions posed by manned space flight.

Vought Astronautics has already faced and solved many problems during initial development of the Dyna-Soar orbital boost-glide vehicle. Develops total studies and feasibility tests by this division have added up to over two years of pathfinding—particularly in the areas of integrating man and space machine, combating prolonged high temperatures, and designing reliable crew escape systems.

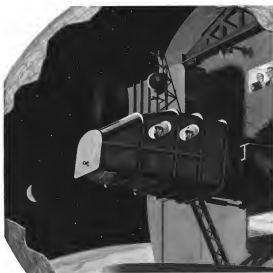
To determine, for example, what control complexity the space pilot must have and what displays he will need, Vought Astronautics constructed a Fixed-Base Simulator which simulates real time from end of boost, throughout orbit, re-entry, hypersonic glide and supersonic approach to a point over destination.

Operated under normal and emergency conditions at more than 200 "g's," this simulator has provided a base for evaluating pilot ability to do complex space missions reliably and effectively with manual control.

In the structure design and systems development on the Dyna-Soar, some action and escape could. Vought Astronautics developed new methods for combating the extreme heat of the nose cone during re-entry while maintaining the crew compartment at a livable temperature. Related tests in Vought's Recovery Temperature Simulator have subjected a full-scale nose cap to over 3,000 degrees F. for prolonged periods.

Vought Astronautics' simulator concepts are the vanguard of a new family of research tools—comparable in value to today's wind tunnels and computer lab facilities—and aimed at ensuring a place for man in penetrating this new frontier—space.

Space is the specialty of Vought Astronautics. Other space ventures are being vigorously advanced in the Aerospace Division, Electronics, Space Systems and Research Division.



### A PLACE TO IRON OUT THE STRESSES OF SPACE

Sixteen different stresses will fly the muscle and bones of the first specimens. Under the combined attack of acceleration, anxiety, heat and other stresses, how will man perform? The answer won't be known until the problem can be simulated, in all of its parameters. Vought Astronautics—a division of Chance Vought—is preparing the way with design studies of simulation like that shown here.

Inside the laboratory's mock space vehicle, a man—without leaving the ground—would know the heat, movement, noise—and many psychological effects—of an extra-terrestrial voyage. He would glimpse a dynamic audio system and would experience, altogether, an insurable preview of combined stresses of space flight. Vought Astronautics can produce and operate such a lab now for the development of spacecraft and the training of pilots.



From zero light intensity, motion and a close beam perspective—a realistic preview of space flight.











**R. E. McCusker, General Manager, Remington Rand Univac Military Division**, who has guided the development of some of the most significant military systems.



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**ARMED** — the General Guidance Computer for the U.S. Air Force (G-7) and (G-8).



### Lockheed JetStar Refitted With Four Engines

Lockheed JetStar prototype is fitted with four Pratt & Whitney JT12 turbojets after two years of flying with two turbine engines. Other work on installing dual landing gear and high-lift wing leading edges. The improved prototype will fly in March; first production model JetStar will fly in July.

### PRODUCTION BRIEFING

Remington Division of Avco Corp., Stratford, Conn., will build a 900-shp 151-L5 turbine engine for the Bell HO-10 helicopter. The contract from the Air Materiel Command, Wright-Patterson AFB, amounts to \$2,485,000 and is expected to reach \$7 million. The engine is identical in size with the 1600-shp version used in the HU-1A and has an improved specific fuel consumption of 570.

Goodrich Tire & Rubber Co.'s Akron Products Division is developing a synthetic rubber liner for the Mustang race car's third stage rocket engine. The liner, covering an diameter from 8 ft to 12 in., forms an annular duct with the solid propellant, reducing the weight and size of the engine and lowering the mass ratio of its product when the rocket reaches peak thrust. The cylindrical liner is 5.5 ft. long and weighs over 1 ft. in diameter.

International Business Machines Corp. is now turning out NPN effect position transducers at the rate of 1,000 in. based on an automatic assembly line at its Rensselaer plant, according to the firm. Assembly systems has been operating successfully on a test basis for one month. Another automatic assembly system for making mass trans-

ducers for the Nike Zeus program is being developed at Western Electric (AW Nov. 30, p. 74).

Harvard Graduate School of Business Administration will determine administrative and economic characteristics of the development and early government of advanced weapons under a \$185,000 grant from the Ford Foundation. Grant also covers research

of the relationship between the government as buyer and its weapons contractors.

Aerogeneral Nuclear, a subsidiary of Aerogeneral Corp., is designing a pulsed neutron reactor for the Atomic Energy Commission for studying effects of radiation on materials. Preliminary design phase will be completed in six months.



### Ryan Vertiplane in Flight

Aerogeneral Vertiplane, which was delivered in a crash after jettisoning up through 380 deg. (AW Feb. 1, p. 14) is shown with large retractable wing flaps in extended position. Work done to a further is delivered to the Ryan Vertiplane.





## Umbilical

The MSC-built Umbilical Locking Cable... is an example of the product diversity of Missile Systems Corporation. Like all products that bear the MSC label, this system has proven its reliability. Just as it is a life-line to the success of a mission, so also are MSC's construction materials to the future accomplishments of all fronts of the electronic industry. MSC's variety of products flows from unified life-line... drawing an industry which is already changing the life patterns of generations to come.

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### Transportable Oxygen Generator

Generating unit extracts oxygen from the atmosphere and supplies continuous amounts of the gas at low pressures for welding and medical applications.

The generator, called Aero-Ox-Gen, supplies oxygen at 5 psi or less three one minute after activation. The generator unit is powered by ordinary house electrical current but operates on battery-powered units are placed in field operations. The portable model is about 12 in. square and weighs 13.5 lb. Chemical Division, Aerojet-General Corp., Azusa, Calif.

### Pressure Transducer

Submersible absolute pressure transducer is designed to meet requirements of marine, aircraft instrumentation.

Model 833 transducer, utilizing a Ni Spinel-C ceramic capsule produces an electrical output proportional to the absolute pressure. Capsule displacement is transmitted to a piezoresistive transducer producing an a.c. or d.c. signal that can be used without amplification. A stainless steel-housing enclosure



resists wear and the effects of vibration and acceleration. The transducer is compatible with conductive gases or liquids and operates atmospherically. Liquid oxygen compatibility may be provided in all pressure ratings.

Specifications for typical pressure

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ratings of 0-10 to 0-150 psi are static error band plus or minus 1.5%, power rating of 5 w at 100V, operating temperature of -65 to 200V. Transducer measures 1 in. diameter by 1.6 in. and weighs 4 oz.

Bores, Inc., P.O. Box 2812, Riverside, Calif.

### Stretch Forming Sinks

Filter sinks for use in stretch-forming aircraft and missile parts is constructed of 8005 or black aluminum foil. The material, ranging in price from \$8 to \$8 cents per sq. in. (aluminum)



ing in cross section completely 1, is said to be more common than conventional filter. The sink, called 100-01, (processes before exposure) is easily sealed for storage, and may be washed to make it reusable. Filter sinks.

Heard Products, Inc., 2332 Fourth St., Berkeley, Calif.



### Ground Power Track

Mobile ground power unit supplies electrical power to a Cessna 440.

The generator of the Hobart Model 2034 unit is rated at 60 kw or 40 kw at 8.8 ph, 120/208 v, 166 amp, three phase four wire 400 cps a.c. A V is of 157 hp, 590 in. in diameter, is coupled to the generator and both are mounted on a steel base, enclosed in steel canopy and mounted on a truck. Castalls for the generator and engine are located in a single panel with the power cable.

Motor Generator Corp., Troy, Ohio



### Molded Glass Fiber Insulation

Carbon molded glass fiber insulation for use in aircraft fuselage permits maximum use of cooling or with little increase in weight.

In the insulation illustrated, two sections perform the insulating job done by many wall sections joined to the metal. The existing characteristics of the glass fiber also increase the shock resistance of the chassis.

Fiberglass Glass Products, Inc., Also Plans, Melville, N. Y.



### High Speed Camera

Ultra high speed motion picture camera, combining optical electronic and mechanical principles, can take from 450 to 1,000,000 pictures per second (unattended) 35 mm film, in black and white or color. Applications for the unit include fuel detonation studies, solid rocket combustion (plasma studies) and electronic fire patterns.

The camera employs an electronic cell shutter which controls the passage of light by means of rapid electronic pulses. When a high energy electronic pulse is applied, the light is polarized in such a manner that it passes through two polarized filters. A mirror rotating at 90,000 rpm in the center of a circular film box directs the image into the shutterless film. Light source provided for the 95 to 1.5 microsecond exposure times produces 450,000,000 lumens with 1 milliwatt of incident energy. Camera weighs 700 lb., camera control unit, 110 lb., light control unit, 800 lb. Bore-Loft Corp., 1850 Franklin St., Santa Monica, Calif.



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## WHO'S WHERE

(Continued from page 33)

### Changes

**Drew** William Mason, manager, Solid State Physics Laboratory, Los Alamos, Santa Monica, Calif.

**Charles J. Cline**, director of marketing, Lockheed Electronics-Norport Division, Los Angeles, Calif.

**Dr. Raymond H. Warren, Jr.**, chief engineering development, Semiconductor Division of Motorola Inc., Phoenix, Ariz. Also **Dr. Robert J. Gaudinger Jr.**, director, semiconductor division.

**Aurilio Stevens**, manager of information services, The Martin Co., Washington, D.C.; also **Alan Joseph M. Doherty**, manager of information services for the Nuclear Division.

**Charles H. Riedel**, senior project engineering manager, Technical Products Division of Perkin-Elmer Electronics Corp., Los Angeles, Calif. Also **John M. Evans**, manager of optical products manufacturing in the division.

**E. H. Ogata**, manager for planning, Defense Electronic Products, Radio Corporation of America, London, N.Y.

**Albert H. Ryan, Jr.**, manager of advanced development, Raytheon Co.'s Missile Systems Division, Waltham, Mass.

**Dr. Robert J. Clark**, deputy director, Federal Aviation Agency's Aeronautical Research Institute, Dayton, Ohio. Also **John F. Gills**, acting director, Traffic-Dynamics Division of American Rockwell Aircraft Corp., Philadelphia, Pa.

**A. G. Rosenzweig**, director of control research and sales engineering, command programs, Douglas Aircraft Co. Inc., Santa Monica, Calif. Also **B. Anderson**, chief manager research and development, J.C. Penney & Co. Inc., Los Angeles, Calif.

**Dr. John L. Griggs**, chief engineer, Applied Technology, Palo Alto, Calif.

**Dr. Donald A. Davis**, director of the newly formed Research Division of Intel Micro-Systems, Inc., San Carlos, Calif. Also **Alvin A. Hinkley**, manager of EC AC Spec. Prog. Division of General Motors Corp., Milwaukee, Wis.

**Norman Winters**, director of public relations, Westinghouse Electric, Southfield, Mich., Calif., according to V. Cline, resigned Mr. Cline will continue in a consultant.

**F. Paul Walsh**, director, Space and Weapons Systems Division of GEIR, Inc., Arlington, Va. Also **Erin W. Wainwright**, director of the Management Engineering Division.

**Thomas C. Clark**, general manager, Houston Products Division, Los Angeles, Calif., of Houston Products Corp. Also **James Harrison**, assistant classification systems and Research Spec. team staff engineering communications research.

**William E. Keele**, manager-engineering, General Electric Co.'s Light Alloy Electronics Department, Utica, N.Y.

**John F. Joanne**, technical operations manager, Research Laboratory, Electron Tube Division, Los Angeles, San Carlos, Calif. Also **John F. Joanne**, director of engineering, Boston Division of Massachusetts Tool and Register Co., Boston, Mass.

### \* Radar Systems Engineer

EE or Physics degree with a minimum of 3 years' experience in the design, development or analysis of advanced radar systems. Work will consist of Analytic Preparation of Specifications, Vendor Liaison, Test and Evaluation, Flight Development of the latest airborne radar equipment and systems. Responsibilities include the development of support equipment for these systems.

### \* Digital Computer Systems Engineers

BSEE with a minimum of 5 years' experience in the design, development and analysis of digital computers. Should be thoroughly familiar with logical design, control techniques, standards, standards, magnetic storage devices and programming. Must be capable of integrating the computer system with the entire Avionics System.

### \* Automatic Flight Control Systems Engineers

EE or Physics degree with a minimum of 3 years' experience in the design and development of autopilot and flight control systems. Work will involve the development of airframe flight control systems and the evaluation of military aerospace test equipment requirements.

### \* Communications Equipment Engineer

Electronic Engineer with a minimum of 3 years' experience, with thorough knowl-

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edge of digital waveform theory and its application. Should possess a complete understanding of AM, FM, PM and single tone modulation processes and their application as well as multiplexing. Must have experience in analyzing and testing communication systems and transmitters, and should be thoroughly familiar with HF and VHF systems and associated programming facilities. A background in digital equipment, assembly, disassembly and magnetic storage devices is an important consideration.

### \* Laboratory Equipment Engineers

BSEE with 2-10 years' experience in laboratory test programs of airborne Avionics equipment. A working knowledge is required of a variety of the fields of electronic communications, detection, electrical systems, automatic flight control and integration. An understanding of commercial power systems electrical distribution, building design and electronic test instrumentation of all types is also necessary.

### \* Avionics Support Equipment Engineers

Electronic Systems or systems engineer of technical degree, computer, advanced radar systems, and navigation and communication systems. This position will establish test point requirements and test plans for military avionics test test devices and equipment and maintenance, Data Display, Data Processing, Electronic Countermeasures, Inertial Guidance, Magnetic Detection Navigation, Radar.

### \* Radio Interference Control Equipment Engineers

Engineers to analyze the source of radio interference and reduce noise interference caused by the interference of complex electronic equipment and systems, and develop methods and techniques to suppress the interference in the advanced design units of aircraft and missiles.

### \* Radar and Avionics Design Engineer

BSEE or Physics degree with a minimum of 3 years' experience in radar design. Should possess a minimum of 100,000 hours of design and development. Work consists of analysis and synthesis of radars or systems on internal and external designs, including the use of the IBM computer facilities to develop design requirements.

### \* Technical Liaison Engineers

Minimum 2 years combined industrial education and experience. Work will consist of liaison in the test and adjustment of advanced electronic equipment both in a laboratory and after installation in aircraft. Area of work experience should include one or more of the following: Autoland Instruments, Avionics Power Systems, Avionics Flight Control Systems, ASW Equipment, Avionics Data Computers, Data Communications, Data Display, Data Processing, Electronic Countermeasures, Inertial Guidance, Magnetic Detection Navigation, Radar.

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## SEARCHLIGHT Equipment Locating Service

NO COST OF OBLIGATION  
This service is used to locate equipment, to locate surplus and used equipment and equipment located and returned to the owner. (This service is for the U.S. and Canada only.)  
How to use: Check the dealer ad to see if what you want is not already advertised. If not, send us the specifications of the equipment wanted on the coupon below, or on your own company letterhead letter.

## Searchlight Equipment Locating Service

SEARCHLIGHT EQUIPMENT LOCATING SERVICE  
P. O. Box 12, N. Y. 36, N. Y.  
Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

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## FOR ADDITIONAL INFORMATION

### About Classified Advertising

Contact  
The McGraw-Hill Office  
New York

ATLANTA, 3  
1201 Woodruff Building  
Atlanta 2400  
S. F. POWELL  
BOSTON, 14-250 Park Square  
Boston 2710  
J. J. ROBERTS

CHICAGO, 11  
320 N. Dearborn Ave.  
Chicago 4-5880  
W. ROBERTS  
CLEVELAND, 13  
1148 Broadview Rd.  
Cleveland 3-7000  
W. S. ROBERTS

DALLAS, 3-1712 Commerce St.  
Dallas 7-1712  
Vaughn Bldg.  
Dallas 7-1712

DENVER, 3  
1700 Broadway-Tower Bldg.  
Denver 3-2961  
J. J. ROBERTS

DETROIT, 26-1336 Parkview Bldg.  
Detroit 2-7772  
J. J. ROBERTS

LOS ANGELES, 12-1122 W. 4th St.  
Los Angeles 2-5430  
H. ROBERTS

NEW YORK, 36-360 34th Ave.  
New York 3-3636  
H. ROBERTS

PHILADELPHIA, 3  
300 N. 3rd St.  
Philadelphia 3-3636  
H. ROBERTS

PHILADELPHIA, 3  
300 N. 3rd St.  
Philadelphia 3-3636  
H. ROBERTS

## ADVERTISERS IN THIS ISSUE

AVIATION WEEK, FEBRUARY 25, 1960

A. C. ELECTRONIC SYSTEMS OF N.Y.	10	WILSON ELECTRONIC CORP.	11	THOMAS ELECTRIC CORP. OF N.Y.	12
ALBANY ELECTRONIC CORP.	10	WILSON ELECTRONIC CORP.	11	THOMAS ELECTRIC CORP. OF N.Y.	12
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ALBANY ELECTRONIC CORP.	10	WILSON ELECTRONIC CORP.	11	THOMAS ELECTRIC CORP. OF N.Y.	12

## PROBLEMATIC RECREATIONS 3



Find the smallest number (x) of persons a best way carry to that (x) person complex can cross a river in such a way that no woman ever crosses in the company of any man unless her husband is present. Also find the least number of passages (y) needed from one bank to the other. Assume that the boat can be rowed by any person only.

The exceptional is the trend in our digital display systems in well as a central computer systems using core storage, register design, and semiconductor. Have your exceptional design ability? Write to Mr. R. W. Robinson

ANSWER TO LAST WEEK'S PROBLEM: 2x=3(3x-4)+4, 3x=4(3x-4)+4, 2x=10

**LITTON INDUSTRIES**  
Electronic Equipment Dept.  
Beverly Hills, California









# STORM

## WARNING... BY RADAR

Atmospheric turbulence has the characteristic of reflecting microwave signals, with the degree of reflection depending on the severity of the turbulence. Returned to the aircraft, this reflected radar warning is displayed in a manner that warns the pilot of the exact location and extent of the turbulence, enabling him to change his course and fly around dangerous storms. Since the radar display also shows him "holes" in storms where there is little or no turbulence, the pilot can choose a course that will result in maximum safety and minimum delay.

Commercial airlines use Varian klystron-equipped weather radar to assure the comfort and safety of passengers and the reduction to a minimum of storm hazards and delays. Photo above shows radar antenna inside the Radome nose of a United Air Lines plane.

In addition to the technical advantages of Varian klystrons to the equipment designer, their rugged mechanical construction and long life are vital benefits to the user. These characteristics are reasons why Varian has become the world's largest manufacturer of klystrons.



**VARIAN associates**

PALO ALTO 22, CALIFORNIA

TUBE DIVISION

Representatives thruout the world

KLYSTRONS, WAVE TUBES, GAS SWITCHING TUBES, MAGNETRONS, HIGH VACUUM EQUIPMENT, LINEAR ACCELERATORS, MICROWAVE SYSTEM COMPONENTS, TMR & EPD RECTIFIERS, TUBES, MAGNETS, MAGNET MOTORS, VALVES, POWER AMPLIFIERS, GRAPHIC RECORDERS, AUTOMATIC AND SEMIAUTOMATIC DEVICES